The New Zealand

Journal of Agriculture.

VOL. XL. WELLINGTON, 20TH MAY, 1930. No. 5.

CONTROL OF RAGWORT AND OTHER WEEDS BY SPRAYING.

REMARKABLE RESULTS WITH SODIUM AND CALCIUM CHLORATE.

J. W. DEEM, Director, Fields Division, Department of Agriculture.

FOR the last twenty years or more various sprays have been tried for the control of ragwort. Some have been a partial success, but owing to such difficulties as poisoning of stock, excessive cost of material, cost of application, and failure to actually kill a large proportion of the ragwort-plants none have been sufficiently practicable to come into general use.

During the past six months the Fields Division has been testing the merits of sodium chlorate and calcium chlorate for the control of ragwort, with very gratifying results. Where properly applied the chemicals mentioned completely destroy all the plants and stand out far above any other sprays for the control of ragwort that have come under the writer's notice. In addition to the control of ragwort they appear equally effective for pennyroyal, St. John's wort, ox-eye daisy, and many other soft-leaved weeds, while there are indications that they will be valuable in the control of Californian thistle and similar weeds. However, further work is necessary before reliable information will be available in respect to these latter plants.

POINTS OF INVESTIGATION AND TRIAL RESULTS.

A start was made to experiment with chlorates on ragwort in October, 1929. The main points of investigation were: (1) The effect of the spray on weeds; (2) the best time to apply it to secure the greatest efficiency at the least cost; (3) the most suitable strength to use; (4) the best method of application—whether as a spray or in dry form; (5) the effect on pasture.

Careful work was carried out under the several aspects, and the results may be summarized as follows:—

(1) On ragwort, pennyroyal, St. John's wort, ox-eye daisy, and similar soft weeds a 100-per-cent. kill was obtained where all plants

were properly sprayed. It may be mentioned here that only a light wetting of the plant with the spray is necessary.

(2) The best results were obtained when the plants were young, so long as there was sufficient foliage to hold the spray. For instance, ragwort was best treated when it was from 3 in. to 9 in. high. Areas at this stage treated in October have shown no signs of recovery. Older ragwort right up to the flowering stage is equally well destroyed, but a great deal more time and material are required to cover the plants; besides, where the plants are allowed to grow big a certain amount of suppression of pastures has taken place.

(3) The material was tried as a spray at strengths varying from 1 to 10 per cent.—1 lb. of material to 10 gallons of water up to 10 lb. of material to 10 gallons of water. It was soon discovered that the stronger strengths were not desirable, and generally it has been found that 4 to 5 per cent. gives the best all-round results. But 2½ per cent. has given excellent results with ragwort, and even 1 per cent. has given 60 per cent. of kill on tall ragwort in full flower. Until such time as definite strengths have been further tested our advice is to use from 3 to 5 per cent., according to the age of the plants. In no case has the material at these strengths failed to give 100 per cent. kill. The spray has very little effect on the plant for the first twenty-four hours, but after this it gradually changes colour, and is dead in about a week. Spraying should not be done while it is raining, but in the trials where rain came on an hour or two after spraying it did not appear to have any detrimental effect on the results.

(4) The calcium chlorate was applied as a spray, but the sodium chlorate was tested both as a spray and in the dry state. The latter method was equally effective where the crystals were applied direct to the weed, but was a great deal more costly, both as regards time taken to apply and cost of material. Therefore spraying is recommended for general work.

(5) Spraying with strengths up to 5 per cent. had little detrimental effect on the grass, but stronger solutions caused considerable burning; likewise the dry applications. It was also noted that any burning in the spring during the growing-period, and when rain was frequent, disappeared in a few days, whereas summer burning took a longer period for recovery.

General Notes.

Both sodium and calcium chlorate are safe so far as stock are concerned, and spraying may be done while the paddocks are being grazed. Mr. C. S. M. Hopkirk, Officer in Charge of the Wallaceville Veterinary Laboratory, has drawn my attention to a statement in the *Cornell Veterinarian* that sodium chlorate in fairly large doses is claimed to be a tonic for cattle. While both chlorates have done excellent work here, it is considered that the sodium has given the better results. The question as to which chlorate to use will greatly depend on cost of material and convenience of transport. The general question of costs of sodium and calcium chlorate is at present receiving attention. The material used up to the present has cost less than 3d. per pound f.o.b. London, and slightly lower quotations have now been received.

Sodium chlorate is supposed to be easily inflammable when dry on clothing. Users are therefore advised to wash any clothes that

may become saturated with this material during spraying operations before allowing them to dry. Calcium chlorate has the advantage that there is not the same danger from fire. Sodium chlorate, while quite safe to handle, forms explosive mixtures with a number of other substances—for example, strong acids, sulphur, and sugar. It should therefore always be used alone (as powder or dissolved in water as instructed above) and never mixed with other substances.

From the farmer's point of view these chlorates have the great advantage that they completely kill ragwort and similar weeds; the work can be carried out without fear of poisoning stock; what is really of the greatest importance is that the weeds may be tackled as soon as they show above ground in the spring, and the work practically

RAGWORT CONTROL TRIAL AREA ON W. HOOPER'S FARM AT WAIPUKU, TARANAKI.

Foreground, and background up to fence, sprayed with sodium chlorate; centre, cut and showing second growth of ragwort.

[*Photo by H. Drake.*

completed before the busiest time of the year sets in; and when the weeds are sprayed in the young stage the cost of material is not great. It must be remembered that all ragwort does not appear at the same time, so it is necessary to go over the farm several times in the year and spray what weeds are showing at the time. At the Stratford Demonstration Farm it was necessary to go over the field three times. The main crop was treated in November, and later in January and February, when certain plants that had been missed in the first spraying were killed.

It is very difficult to arrive at the quantity of material required to spray an acre of land infested with ragwort. For instance, on the Stratford Demonstration Farm, where only scattered plants were to be found, approximately 1½ lb. of material per acre was used, whereas on

another farm, where a fairly solid block of 5 acres of ragwort standing about 3 ft. high was treated, approximately 22 lb. of sodium chlorate per acre was used. Although most of the plants on this area were in bloom, the effect of the spray was such that all were killed and no seed ripened, as would have been the case had the plants been cut and allowed to lie. This is important, preventing, as it does, reinfestation by seeds.

The work carried out clearly indicates that spraying with chlorates is much faster than either cutting or pulling, and the expenditure in material is amply recovered in the lesser labour involved. In addition, the chlorates definitely kill, and therefore give promise of providing the farmer with a method whereby the elimination of ragwort may become possible.

The foregoing matter may be regarded as preliminary. More definite information and instructions will be given in a further article to be published shortly in the *Journal*.

ANTE-NATAL DEFORMITY OF LAMBS.

A PRELIMINARY INVESTIGATION IN OTAGO.

C. S. M. Hopkirk, B.V.Sc., Officer in Charge, Wallaceville Veterinary Laboratory.

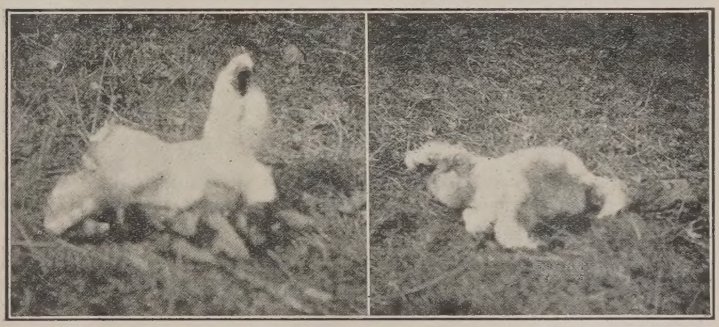
For several seasons farmers in parts of Otago have been reporting a serious loss at lambing-time from deformed dead fœtuses. An opportunity was recently afforded, during an investigation into mortality of lambs from so-called pulpy kidney, to obtain definite information on the subject, together with specimens and histories, from a number of the farmers concerned.

Regarding the type of monstrosity, there is only a rudimentary mandible, shown as two rounded protuberances at the base of the skull. The inferior maxilla is overshot and gives the general appearance of a seagull's head. The legs are shortened and often of different sizes, but have the correct number of bones. The spinal column is arched, and some of the cervical vertebræ are fused. The wool has grown normally, but the whole fœtus is expelled with the membrane. Many ewes have difficulty in lambing in such cases. Frequently there are twin lambs, the one deformed, the other apparently normal but very often with little stamina. Many lambs born alive in affected flocks are unable to use fore or hind limbs, and die from starvation before the third day. Where the farmer has to give help to a lambing ewe it must be done with the utmost aseptic precaution, or the ewe may die from septicæmia. Many ewes are unable to lamb at all and have to be destroyed. A post-mortem examination of such a case shows intense œdema of the uterus and uterine horns, and especially of the uterine cotyledons. There is often a large quantity of peritoneal fluid, the result of the œdema.

Microscopical sections of the organs of a ewe gave results as follows: Pituitary body: The posterior portion contained hæmorrhages which may or may not have been due to rough excision of the gland. The anterior portion appeared intensely congested. Uterine wall: Very much

thickened and œdematous. The glandular epithelium was normal, but the lumen of glands contained many polymorphs and a few lymphocytes, the cells having worked through the glandular epithelium from the connective tissue. No organisms nor metritis were in evidence. Cotyledons: Œdema beneath body of cotyledon and to some extent on free surface. Villi of cotyledons becoming detached. Normal but for œdema. Kidney: Slight congestion of glomeruli. Very slight excess of fluid in connective tissue. Otherwise normal.

It has been observed on some of the affected farms that the lambs from the affected flock which live are inclined to be more susceptible to death from so-called pulpy kidney at from two to four weeks of age, and one such case may be given. One hundred and three half-bred ewes mainly, with a few crossbred Romneys, two-tooth to eight-tooth, were bought on 26th April, 1929, and Romney rams were used



DEFORMED LAMBS ON ONE OF THE AFFECTED FARMS.

The monstrosity on left has a seagull-shaped head. In both cases the lower jaw is missing and legs are short. Photos taken 14/10/29.

on them. In October and November seventy-five lambs were born deformed or paralysed. There were also seventeen lambs lost from pulpy kidney.

There seem to be four possible reasons for the production of deformed fœtuses: (1) A lethal factor in the Romney rams, (2) ergotism, (3) iodine deficiency, (4) faulty sheep husbandry and type of pasture.

(1) *Breeding Factor.* — Notes of cases given later will show that genetics are not likely to be a factor. The condition appears in Romney, Corriedale, or half-bred ewes, and from Romney, half-bred, Corriedale or English Leicester rams, irrespective of the part of the country from which they originated. It so happens that Corriedales, half-breds, and Romneys are the chief breeds of the district in question. In the neighbouring district where losses occur Romney only have shown the fault, but the Romneys are greatly predominant in numbers.

In one season the same rams on the same lot of ewes have produced monstrosities, while the year before or the year after on a different class of country the lambs born have been normal. Ewes which have had deformed lambs one season have had normal lambs the following season, even to the same ram. The percentage of deformities, too, is

high, and would appear to be too high for lethal factors in sheep so widely unrelated, even had they all been Romneys as was originally held.

(2) *Ergotism.*—From the fact that pastures were noticed two years ago to be usually Chewings fescue, the possibility of the continuous action of ergot on the pregnant uterus was considered to be the most plausible explanation. This season, however, cases have been found where the ewes did not have access to ergotized grasses, and this applies particularly on one farm where for three years in succession the affected sheep have been running on turnips, with a run-off on to bare tussock which contained small quantities of *Poa colensii*, hair-grass, danthonia, Yorkshire fog, catsear, and pimelia.

(3) *Iodine Deficiency.* — This was considered a possibility, based mainly on the fact that an experiment of excision of the thyroid glands which was supposed to have been performed in India resulted in a similar deformity being reproduced. Analysis of thyroids for iodine in deformed fœtuses gave results as follows :—

	Weight of Gland. Grammes.	Iodine Content. Grammes.	Percentage of Iodine calculated on Fresh Weight.
(1) ..	.. 1·30	0·0003	0·019
(2) ..	.. 7·08	0·0054	0·077

(A normal fœtus should contain 0·03 per cent. of iodine on fresh weight.)

Pasture analysis for iodine in another pasture adjacent to the one in which deaths occurred gave the following results : 38 gammas, 42·45 gammas, 53·56 gammas.

An analysis of pasture samples carried out in the laboratory of the Chemistry Section, Department of Agriculture, gave the following results (expressed as percentages of the dried matter, except for iodine) :—

——	Ash.	Crude Silica.	Soluble Ash.	Iron (Fe).	Alumina.	Phosphoric Acid.	Calcium Oxide.	Magnesium Oxide.
Chewings fescue	8·92	5·88	3·04	0·014	Trace	0·45	0·44	0·23
Blue tussock ..	6·25	4·07	2·18	0·016	Trace	0·29	0·27	0·17

——	Chlorine.	Iodine in Gammas per 100 Grammes Dry Material.	Manganese (Mn).	Sodium Oxide.	Dipotassic Oxide.	Nitrogen.	Sulphur.
Chewings fescue..	0·275	42–45	0·068	Trace	1·12	1·61	0·15
Blue tussock ..	0·29	..	0·006	0·06	0·91	1·18	..

The analysis shows a sufficiency of iodine in the animal and in the pasture. There is, however, a very low mineral content in the pasture, and the blue tussock was much worse than the Chewings fescue. Sodium chloride, also, is notably deficient, but that is so all through the district.

No analysis has yet been made of the bones of the ewes, to ascertain whether the deficiency of minerals in the pasture could have caused a definite deficiency in the body of the ewe in the short time of gestation.

(4) *Sheep Husbandry and Pasture.*—The type of pasture appears to have a very great deal to do with the condition under discussion. In all cases the ewes have had access for a large part of the gestation period to coarse fibrous grass of a very low nutritional value. Many flocks have been fed on turnips with a run-off on to fescue or tussock (a mixture of *Poa colensii* and other poor grasses being included), but other cases have occurred among ewes run on the rough pasture alone so as to avoid overcondition at lambing. It has been a striking fact that ewes placed on good grass-paddocks—*i.e.*, rye, clover, and cocksfoot—have shown no sign of the trouble.

So impressed are the farmers where the deformities have been found that rough pasture is at the bottom of the trouble that they are either getting rid of fescue altogether, or keeping stock on turnips alone or on English grasses during gestation—practices which have given them relief from the trouble. It is difficult to arrive at a reason for the deformity and for the œdema of the uterus from the observations made, but something may result from experimental work planned for next lambing-season.

In order to overcome the losses farmers are advised to keep ewes off rough pasture during gestation, and where a run-off from turnips is required to see that the pasture is short and good. Especially should ewes be kept off fescue. If fescue-paddocks are a necessity they should be grazed closely and no roughage allowed to accumulate. It might be possible to let wethers eat this type of feed out earlier in the season.

The experimental work in hand is briefly as follows :—

(1) Twenty ewes and one ram were obtained in the North Island, their breeding history being irreproachable. These have been sent to a selected farm in an affected locality, and are being run on Chewings fescue with the object of finding whether their lambs will become deformed. They will possibly be kept two years on this farm.

(2) Two ewes were thyroidectomized at the Wallaceville Laboratory with a view to breeding from them. One ewe died from post-anæsthetic pneumonia, but the other has been put out with the ram. A third ewe is to be operated upon after tupping.

Farmers' Experiences.

The following is a summary of experiences gathered with the assistance of Mr. D. Weir, Inspector of Stock, Ranfurly, from local farmers :—

J. A. (Hyde).—In this case there were 150 deformed lambs among 300 half-bred ewes, four-tooth, in 1928. The same ewes, as two-tooths in 1927, bred to Romney rams, had no deformed lambs in a 100-per-cent. lambing, but they were grazed on a different type of pasture, a rye and clover mixture, with an occasional change to 150 acres, half of which was mixed English grass pasture and the remainder Chewings fescue. The 1928 winter was spent on rank Chewings fescue and tussock alternately. The same Romney rams were used in both seasons, and came from three well-known breeders. In 1929 160 full-mouth half-bred ewes, bought farther inland on 10th April, were put on rank fescue for six weeks ; Romney rams were with them three weeks ; then changed to English mixed pasture, but brought back on to fescue for a fortnight in July, after which they were on ordinary

pasture till lambing. Forty deformities were produced. The later-lambing ewes of this lot, which would have been tupped on English grass, had no deformed lambs. Deformities were not so marked as in the previous year. The 300 ewes which had previously produced deformed lambs were again bred to the same Romney rams, with a few new rams added, and kept for two months on English pasture. They were then sent to good tussock hill-country containing trefoil, clovers, &c., till lambing. The lambing percentage was large. This farmer always has ewes well conditioned at tupping-time. He also believes pulpy kidney to be more pronounced in the flocks affected with deformed lambs.

J. N. (Oturehua).—First trouble in 1926; thirty deformities from 300 ewes, Romneys, merino cross, and Corriedale cross put to Romney rams. In 1927 the same ewes had forty deformed lambs. In both years the ewes were wintered on turnips, with run-off on to old English grass and tussock pasture, till August. They were then placed on rank fescue until lambing in October. A cut of these ewes placed on a rye, clover, and cocksfoot paddock at the end of August had no deformed lambs. In 1928 no deformities were seen. The ewes had hay in June, and turnips from 1st July to 20th September, with run-off on old English pasture; then on to English grass till lambing. In 1929 there were six deformities. The flock received turnips from 1st August to 1st October, with pasture and clover hay. Six-tooth and eight-tooth ewes from which three of the deformities occurred had a run-off from turnips to a bare fescue-paddock. Older ewes, where the other three deformities occurred, had hay on an ordinary grass-paddock and no turnips. Rams were changed each season and bought from different breeders.

D. N. (Oturehua).—First loss in 1926. A few deformities in fifty Romney cross ewes wintered on grass and hay, and put in a rough fescue-paddock from 1st May till lambing. 1927: A hundred deformities in 200 Romney cross old ewes in lamb to good Romney rams. Wintered until lambing on rough tussock and fescue paddock, with hay but no turnips. 1928: A hundred deformities from 200 full-mouthed Corriedales by Romney rams. Wintered on rough tussock, with no hay; turnips from August to October, with run-off on fescue. English pasture for lambing. 1929: A hundred deformities in 200 two-tooth ewes (not related to other lots) by English Leicester and Corriedale rams. Wintered on rough fescue-paddock; turnips from 1st August to 1st October, and turned out at nights to bare fescue-paddocks. It is noteworthy that 800 other ewes from English pastures mixed with the 200 two-tooths from 1st August had no deformed lambs. Licks of salt, iodine, lime, and sulphur have been given to the sheep for two years.

W. M. (Kokonga).—In 1928 there were 250 deformities from 800 two-tooth Corriedale ewes by Corriedale rams from well-known and approved pedigree breeders. Grazed on tussock; put to ram on rank fescue for six weeks. Some ewes had turnips, but deformities occurred in spite of these. The ewes remained on the tussock block till lambing. In 1929 there were no deformities. The same ewes and rams were used, but the flock was kept off the fescue-paddock. Kept till lambing on tussock with clover, trefoils, &c., throughout.

E. S. (Wedderburn).—First deformities in 1926; about thirty in 300 two-tooths, while flock made up of 1,000 ewes, crossbreds and half-breds. Whole flock running with ram till 31st July on grass-paddock with natural tussock. Five hundred were then given turnips; of these, 300 two-tooths had a run-off on to natural rough tussock, and 200 had no run-off. Deformities occurred on the tussock run-off only. The remaining 500 ewes were taken to another place in May, six miles distant, after being tupped by the same rams. No deformities occurred. The rams were supposed to be at fault, so were changed for 1927. In that year the flock was treated similarly, but had turnips during August. Ninety-five deformities appeared in a lot of 350 of two-tooth to eight-tooth ewes left on the same paddock as the 300 lot in 1926. The remainder of 800 were in another paddock till 31st August, when they were moved to the property six miles distant. No deformities occurred from these ewes. The run-off from turnips consisted of a natural tussock pasture of 260 acres, which was used from 1st September to 1st October. Ewes of all ages and of two breeds were affected. In 1928, following advice from the Agriculture Department's officers, the owner turniped the ewes as usual, but gave a run-off on to good grass pasture. No deformities occurred. The same rams were used with the same ewes in 1928 as in 1927. Ewes which had deformed lambs in 1927 were marked, but gave birth to normal lambs in 1928.

W. S. (Wedderburn).—The first deformities were seen in 1929, when 520 ewes gave 150 deformed lambs. The ewes had been bought from several different places, and were half-breds and crossbreds. Romney rams were used; 300 of the ewes were tupped in a rough fescue-paddock, and the remainder on rough tussock, and kept there till the end of June. They were put together on 60 acres of turnips on 28th June till 16th September with a run-off on to 200 acres of rough tussock pasture. Each night they were driven off to a second tussock-paddock of 300 acres with no clovers or grass undergrowth. This owner lost many ewes from septicæmia while assisting them to lamb.

Phormium Investigations.—Referring to this matter at a recent meeting of the Research Council, the Chairman stated: "Breeding and selection work is continuing under Dr. Yeates at Massey College, where several promising strains are meriting attention. At the same time "yellow-leaf" disease research is being actively pushed forward. This trouble—possibly being of the virus type—is proving exceedingly difficult of solution. Chemical work is under way, and several methods of softening and bleaching fibre are being actively subjected to investigation.

Yeasts and Moulds in Butter.—Reporting on the organization of the Irish Co-operative Creameries Association, Mr. W. Wright, Inspector of Dairy-produce, London, remarks: "In addition to grading there is a system of taking samples of butter at the grading-store, Dublin, of all boxes of butter graded, both for bacterial and chemical examination. These examinations include yeasts and moulds. Samples for the latter are taken from the butter at the opposite corners of the upper surface of the box. Yeasts and moulds are looked upon here as being intimately connected with dirt due to uncleanliness of utensils, &c., and so much stress has been put on this particular feature that inspectors are advised immediately when butter has been found to contain yeasts and moulds, with instructions to visit the factory where the butter was made and investigate the cause of the trouble."

AN ECONOMIC SURVEY OF DAIRY-FARM GROUPS IN NORTH AUCKLAND, SEASON 1927-28.

(Concluded.)

E. J. FAWCETT, M.A. (Cambridge), Farm Economist, Department of Agriculture.

2. Dargaville Group—Hobson County.

IN the first article, published last month, a group of dairy-farms at Ruawai, in Otamatea County, was discussed. The present analysis deals with 110 farms near Dargaville, in Hobson County, which is bounded by Otamatea on the south, Hokianga on the north, and Whangarei on the east. A portion of the county is adjacent to Kaipara Harbour, but there is also a long sea-coast line. The major portion of the district is hilly or undulating, and it contains a large proportion of unimproved land. Dairying is carried on along the valleys and tidal flats, but farms are on the whole larger than those dealt with previously.

The total occupied area of Hobson County as given in the 1927–28 statistics was 300,212 acres. Of this area 155,800 acres were improved, including 154,700 acres of grassland; hay and ensilage comprised 227 acres only, while 731 acres were under the plough. Thus it will be appreciated that the county produces little other than grass for stock feed. Stock in the county consisted of the following: Horses, 1,990; dairy cows in milk and dry, 19,006; other cattle and young stock, 24,963; sheep wintered 1928, 121,080; pigs (31st January, 1928), 6,532.

The 110 farms in the Dargaville group milked 4,177 cows, or 21·98 per cent. of the total dairy cows in the county. On a sheep-unit basis dairy cows represented approximately 32 per cent. of the grazing-stock of the county.

BUTTERFAT PRODUCTION, SIZE OF FARM, ETC.

In the first four tables farms have been grouped according to production per acre, cows milked per 100 acres productive area, production per cow, and size of farm respectively. Tables are comparable with those dealing with the Ruawai group in every case.

Table 1.—Farms grouped according to Butterfat-production per Acre (Productive Area).

Butterfat per Acre—Range.	Number of Farms in Group.	Butterfat per Acre.	Butterfat per Cow.	Number of Cows milked per 100 Acres.	Number of Cows milked per Farm.	Productive Area.	Non-productive Area.	Total Area.
lb.		lb.	lb.			Acres.	Acres.	Acres.
140–159·9	3	150·4	224·1	67·2	53·7	79·3	10·0	89·3
120–139·9	10	129·9	261·5	51·0	35·4	71·5	17·9	89·4
100–119·9	18	111·9	221·8	51·5	34·7	66·0	10·6	76·6
80– 99·9	24	91·1	205·4	45·5	36·6	82·1	11·0	93·1
60– 79·9	20	68·6	196·7	35·3	42·1	122·6	21·3	143·9
40– 59·9	21	51·9	171·5	30·8	39·0	125·8	25·6	151·4
20– 39·9	14	30·4	150·7	20·9	35·5	183·4	49·7	233·1

Table 2.—Farms grouped according to Cows milked per 100 Acres (Productive Area).

Number of Cows milked per 100 Acres —Range.	Number of Farms in Group.	Number of Cows per 100 Acres—Average.	Butterfat per Acre.	Butterfat per Cow.	Number of Cows milked per Farm.	Productive Area.	Non-productive Area.	Total Area.
			lb.	lb.		Acres.	Acres.	Acres.
60–69·9	10	63·9	123·8	192·9	39·0	60·5	23·3	83·8
50–59·9	15	53·9	112·2	208·3	43·0	79·1	12·3	91·4
40–49·9	25	44·8	96·7	215·7	32·7	73·0	8·9	81·9
30–39·9	35	34·8	70·9	202·7	40·7	117·2	19·5	136·7
20–29·9	18	36·2	45·2	171·4	34·6	131·7	39·8	171·5
10–19·9	8	17·2	27·5	161·6	38·8	228·7	66·8	295·5

Table 3.—Farms grouped according to Butterfat-production per Cow (Productive Area).

Butterfat per Cow—Range.	Number of Farms in Group.	Butterfat per Cow—Average.	Butterfat per Acre (Productive).	Number of Cows milked per 100 Acres.	Number of Cows milked per Farm.	Productive Area.	Non-productive Area.	Total Area.
lb.		lb.	lb.			Acres.	Acres.	Acres.
325–349·9	2	337·1	124·8	37·0	27·5	74·0	2·5	76·5
300–324·9	0	..	..	..	..	..	..	..
275–299·9	2	278·9	102·3	36·7	21·5	60·5	2·5	63·0
250–274·9	8	266·5	115·3	43·3	36·6	85·5	7·4	92·9
225–249·9	13	236·8	108·0	45·5	33·0	77·5	8·5	86·3
200–224·9	32	210·2	89·8	42·8	41·5	108·9	18·3	127·2
175–119·9	22	185·7	73·5	39·8	36·5	101·1	28·8	129·9
150–174·9	16	162·2	54·6	33·7	38·8	134·4	25·8	160·2
125–149·9	10	142·5	53·4	37·4	42·3	121·1	45·8	166·9
100–124·9	5	116·0	31·7	27·4	36·8	147·8	10·2	158·0

Table 4.—Farms grouped according to Size of Farm (Productive Area).

Size of Farm—Range.	Number of Farms in Group.	Productive Area—Average.	Butterfat per Acre.	Butterfat per Cow.	Number of Cows milked per 100 Acres.	Number of Cows milked per Farm.	Non-productive Area.	Total Area.
Acres.		Acres.	lb.	lb.			Acres.	Acres.
20– 29·9	1	28·0	102·0	238·0	42·9	12·0	3·0	31·0
30– 39·9	7	35·5	113·2	216·3	52·9	18·7	10·3	45·8
40– 49·9	10	43·6	109·2	224·5	49·7	21·7	12·5	56·1
50– 59·9	10	54·1	102·0	231·5	43·7	23·6	7·6	61·7
60– 69·9	10	62·9	83·9	193·7	43·4	27·3	19·2	82·1
70– 79·9	8	73·9	65·4	188·8	34·6	25·6	13·1	87·0
80– 89·9	10	85·0	79·8	177·6	45·0	38·1	19·6	104·6
90– 99·9	8	93·8	82·4	207·6	38·5	36·1	6·8	100·6
100–109·9	10	103·2	70·1	178·2	38·9	40·2	25·7	128·9
110–139·9	10	122·2	94·8	221·8	42·2	52·0	9·8	132·0
140–169·9	10	152·7	50·9	172·8	28·7	44·1	59·0	211·7
170–199·9	4	192·0	64·8	166·9	36·7	70·8	46·2	238·2
200–299·9	11	231·9	50·0	177·9	27·7	63·7	39·6	271·5
300–399·9	2	373·5	29·4	186·5	16·2	60·0	92·5	466·0

A number of interesting comparisons may be made between the figures pertaining to the Dargaville and Ruawai groups. The area of non-productive land is considerably higher on Dargaville farms than in

the case of Ruawai. Despite this fact and the possible advantage which may be given if the areas assessed as non-productive are too high, production per acre does not reach the level of the top farms in the Ruawai group. The factor accounting for this position is the lesser number of cows milked per given area, and the range of cows milked shows a much wider variation. The influence of the density of milking-cows more than counterbalances the higher-producing animals found on a few farms in the Dargaville group. The wide range of productive area (Table 4), taken in conjunction with the number of cows milked per farm, clearly illustrates that many of the Dargaville farms are not highly improved even on that area shown as productive. Generally speaking, dairying is not in such an advanced state as in the Ruawai district.

Top-dressing and Labour.

It will be seen that top-dressing is not extensively practised, being in approximately the same stage as at Ruawai. The remarks in the preceding article pertaining to manuring and labour apply equally to the position shown here in Tables 5 and 6.

Table 5.—Manure used for Top-dressing: Farms grouped according to Butterfat-production per Acre (Productive).

Butterfat per Acre—Range.	Amount of Manure.			Lime per Acre (not included in Manure).	Number of Farms in Group.
	Per Acre.	Per Cow.	Per Pound of Butterfat.		
lb.	Cwt.	Cwt.	lb.	Cwt.	
140–159·9	1·5	2·3	1·2	..	3
120–139·9	1·6	3·6	1·4	0·6	10
100–119·9	1·5	3·0	1·5	0·4	18
80– 99·9	1·2	2·7	1·5	0·3	24
60– 79·9	0·9	2·7	1·5	0·5	20
40– 59·9	0·7	2·4	1·6	0·3	21
20– 39·9	0·5	2·5	1·9	0·2	14

Table 6. — Labour: Farms grouped according to Butterfat-production per Acre (Productive).

Butterfat per Acre—Range.	Labour Units per 100 Acres.	Number of Cows milked per Labour Unit.	Butterfat produced per Labour Unit.	Number of Cows milked per 100 Acres.	Number of Farms in Group.
lb.			lb.		
140–159·9.. ..	4·4	15·7	3,504	67·2	3
120–139·9.. ..	4·4	12·3	3,133	51·0	10
100–119·9.. ..	5·0	11·4	2,488	51·5	18
80– 99·9.. ..	3·6	13·5	2,783	45·5	24
60– 79·9.. ..	2·4	16·3	3,184	35·3	20
40– 59·9.. ..	2·4	14·4	2,339	30·8	21
20– 39·9.. ..	1·5	15·4	2,336	20·9	14

Gross Returns.

It will be noticed that in groups of comparable per-acre production range gross returns per 100 acres are lower than at Ruawai. This is accounted for by lesser returns from pigs, and a more serious position

in the cattle account. The position is uniformly lower over the whole range, which indicates that the average conditions obtaining on Dargaville farms offer considerable scope for improvement.

Table 7.—Gross Returns: Farms grouped according to Butterfat-production per Acre (Productive).

Butterfat per Acre—Range.	Gross Returns per 100 Acres.	Number of Cows milked per 100 Acres.	Gross Returns per Cow.
lb.	£		£
140–159·9	1,000	67·2	14·88
120–139·9	1,006	51·0	19·73
100–119·9	828	51·5	16·08
80– 99·9	709	45·5	15·58
60– 79·9	530	35·3	15·01
40– 59·9	402	30·8	13·05
20– 39·9	261	20·9	12·49

Maintenance Expenses.

Expenses of maintenance are lower in the Dargaville than in the Ruawai group. Drainage rates affect only five farms, which materially reduces costs. Owing to the fact that farms are generally larger and contain at least a proportion of dry land, wintering-off is not so extensively practised. Of the whole group only twenty-nine farms winter stock away, resulting in a distinct saving in annual expense. Although a reduction in maintenance expenses has been effected in this way, it is undoubtedly mainly responsible for the lesser per-acre production as compared with the Ruawai group, and the adoption of more wintering-off in the Dargaville area is a question worthy of consideration.

Table 8.—Expenses: Farms grouped according to Butterfat-production per Acre (Productive). (All Figures per 100 Acres.)

Butterfat per Acre—Range.	Manure.	Rates.	Fences.	Cultivation.	Power.	Winter Grazing.	Depreciation.	Sundries.	Total.	Cost per Cow milked.
					Actual Cost.					
lb.	£	£	£	£	£	£	£	£	£	£
140–159·9	46·2	33·8	5·1	10·3	27·2	7·0	11·7	44·2	185·5	2·76
120–139·9	55·1	37·9	21·3	2·5	21·1	5·0	16·6	33·8	193·3	3·79
100–119·9	49·7	36·0	9·8	16·2	15·2	14·9	17·9	24·1	184·1	3·57
80– 99·9	34·9	35·4	7·8	8·2	19·7	13·2	13·2	18·8	151·2	3·32
60– 79·9	33·9	23·0	4·3	6·8	11·7	2·1	11·6	15·7	109·1	3·09
40– 59·9	24·3	19·2	11·2	5·4	7·5	4·8	10·8	10·9	94·1	3·06
20– 39·9	17·9	15·2	3·6	7·1	6·2	2·4	7·1	11·1	70·6	3·38
					Percentage of Total.					
140–159·9	24·9	18·2	2·7	5·6	14·7	3·8	6·3	23·8	100	..
120–139·9	28·5	19·6	11·0	1·3	10·9	2·6	8·6	17·5	100	..
100–119·9	26·9	19·6	5·3	8·8	8·3	8·1	9·7	13·3	100	..
80– 99·9	23·1	23·4	5·2	5·4	13·0	8·7	8·7	12·5	100	..
60– 79·9	31·1	21·1	4·0	6·2	10·7	1·9	10·6	14·4	100	..
40– 59·9	25·8	20·4	11·9	5·7	8·0	5·1	11·5	11·6	100	..
20– 39·9	25·3	21·5	5·1	10·1	8·8	3·4	10·1	15·7	100	..

Distribution of Gross Returns.

In Table 9 the effect of low maintenance expenses and a comparatively low labour reward resulting from the smaller number of cows milked per 100 acres is reflected in certain sub-groups in the interest surplus. This is especially noticeable in the second sub-group, where the number of cows milked drops from 67·2 to 51 per 100 acres. Thus, with this sub-group, if family labour only is depended upon, the interest surplus becomes inflated at the cost of the family reward for labour. This is a typical instance of where a higher price may be paid for land than is warranted by its production, through an underestimation of the worth of labour.

Table 9.—Distribution of Gross Returns: Farms grouped according to Butterfat-production per Acre (Productive).

Butterfat per Acre—Range.	Number of Farms in Group.	Maintenance.		Labour.		Interest.		Total.	
		Per 100 Acres.	Percentage of Total.	Per 100 Acres.	Percentage of Total.	Per 100 Acres.	Percentage of Total.	Per 100 Acres.	Percentage.
lb.		£		£		£		£	
140–159·9	3	185	18·5	470	47·0	345	34·5	1,000	200·0
120–139·9	10	193	19·2	357	35·5	456	45·3	1,006	100·0
100–119·9	18	184	22·2	361	43·6	283	34·2	828	100·0
80– 99·9	24	151	21·3	319	45·0	239	33·7	709	100·0
60– 79·9	20	109	20·6	247	46·6	174	32·8	530	100·0
40– 59·9	21	94	23·4	216	53·7	92	22·9	402	100·0
20– 39·9	14	71	27·2	146	55·9	44	16·9	261	100·0

Interest Surplus.

The following table illustrates the effect of the point just noted, the interest surplus being converted into a high gross capital as a result of low maintenance expenses and labour reward.

Table 10.—Interest Surplus and Capital: Farms arranged according to Butterfat-production per Acre (Productive).

Butterfat per Acre—Range.	Number of Farms in Group.	Number of Cows milked per 100 Acres.	Interest Surplus per 100 Acres.	Gross Capital represented at 7 per Cent.
lb.			£	£
140–159·9 ..	3	67·2	345	4,929
120–139·9 ..	10	51·0	456	6,514
100–119·9 ..	18	51·5	283	4,043
80– 99·9 ..	24	45·5	239	3,414
60– 79·9 ..	20	35·3	174	2,486
40– 59·9 ..	21	30·8	92	1,314
20– 39·9 ..	14	20·9	44	629

Owing to a lesser number of cows being milked per 100 acres, the value of stock and plant is also lower throughout than in the Ruawai group. This again tends to show a better capital position on land and improvements, as shown in Table 11.

Table 11.—Farms grouped according to Butterfat-production per Acre (Productive)

Butterfat per Acre—Range.	Number of Farms in Group.	Number of Cows milked per 100 Acres.	Gross Capital.	Valuation of Stock and Plant.	Net Capital—Land and Improvements	Value of Land and Improvements per Cow milked.
lb.			£	£	£	£
140–159·9	3	67·2	4,929	1,017	3,912	58·21
120–139·9	10	51·0	6,514	902	5,612	110·04
100–119·9	18	51·5	4,043	906	3,137	60·91
80– 99·9	24	45·5	3,414	778	2,636	57·93
60– 79·9	20	35·3	2,486	611	1,875	53·12
40– 59·9	21	30·8	1,314	551	763	24·77
20– 39·9	14	20·9	629	380	249	11·91

The combination of low stock and plant values, low maintenance expenses, and comparatively low cow-density has resulted in quite a favourable capital position, both per acre and per cow milked, when compared with the same production sub-groups of the Ruawai district. Table 12 shows the capital position on land and improvements as established above, compared with Government valuation per 100 acres. It will be seen that they run much more evenly than the same tabulation for Ruawai.

Table 12.—Farms grouped according to Butterfat-production per Acre (Productive).

Butterfat per Acre—Range.	Number of Farms in Group.	Value of Land and Improvements per 100 Acres.	Government Valuation per 100 Acres.
lb.		£	£
140–159·9 ..	3	3,912	3,304*
120–139·9 ..	10	5,612	3,118†
100–119·9 ..	18	3,137	3,636
80– 99·9 ..	24	2,636	3,228‡
60– 79·9 ..	20	1,875	2,463
40– 59·9 ..	21	763	2,098
20– 39·9 ..	14	249	1,788§

* Two farms. † Nine farms. ‡ Twenty-three farms. § Twelve farms.

Conclusion.

In conclusion, it can be said that the two groups discussed are very similar in so far as expenditure on working and upkeep is low. Both groups have heavy replacement costs and are handicapped through lack of personal capital. Dargaville has the advantage of lesser drainage rates, and is not compelled to winter stock off farms to any extent. On the other hand, the ratio of non-productive to productive land is higher, and where non-productive land has even a moderate capital indebtedness it must become a menace to the productive area on which it depends for payment of interest. The fact that wintering on the farm restricts the capacity for milking-cows puts Dargaville in a less advantageous position so far as labour reward is concerned. If the same results were obtained with a lesser amount of labour it would be a decided advantage, but such is not the case.

Attention must again be called to the fact that the season under review had a dry period which affected production to some extent.

In addition to the two groups discussed a survey of dairy-farms in the vicinity of Whangarei was made. It is, however, not considered advisable to publish the figures, as the dry summer experienced in 1927–28 had a very serious effect on the volcanic soils of the Whangarei district.

CORRECTION.—In the second column of Table 7 in the first article (April *Journal*, page 248) the sign "lb." should be "£."

STORAGE OF MAIZE ON THE FARM.

IMPROVED TYPES OF CRIB.

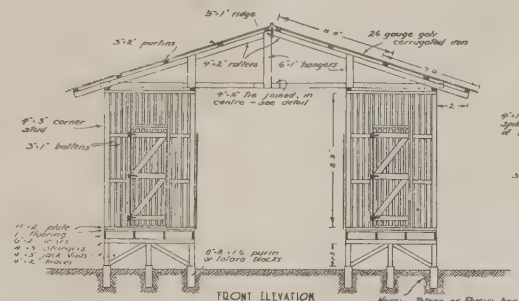
C. WALKER, H.D.A., Instructor in Agriculture, Fields Division, Te Puke.

AT this time of the year, with the maize crops approaching maturity, some attention will be paid on most maize-growing areas to the renovation or construction of cribs for the storage of the cobs, until such time as the grain has fully matured and market prices are sufficiently attractive to induce the growers to commence shelling. This delay in shelling, becoming more pronounced each year, should logically result in the growers providing better storage conditions for the cobs, so as to eventually handle their grain to best advantage.

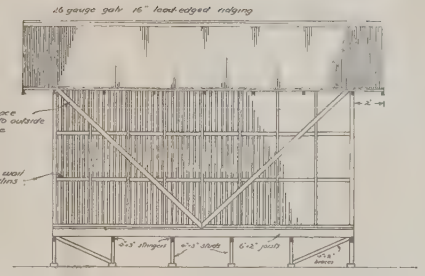
In the earlier days of maize-growing in the Bay of Plenty it was considered that shelling of the cobs should follow their storage for six to ten weeks in the crib, and it was seldom that a much longer period was allowed to elapse on most of the farms where the crop was grown. Consequently storage provision was often of a temporary nature, and as the practice of holding the crop for longer periods developed this storage was often quite inadequate, especially where crops were held for as long as twelve months.

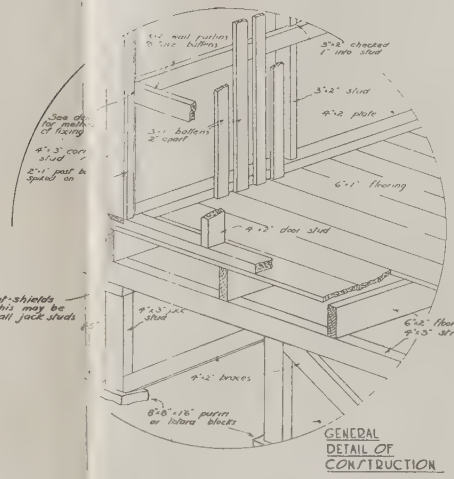
Of the cribs then built the most satisfactory for the smaller growers was the tapering (from top to base) form. Such a crib was usually 8 ft. to the eaves, 5 ft. wide at the base, 7 ft. wide at the eaves, and varied in length, according to requirements, from 12 ft. to 25 ft. As the tapering sides were subjected to severe strains when the crib was filled it was found necessary to provide wall supports in the structure, spaced at 3 ft. to 4 ft. intervals along each side. With the shorter cribs a door at one end was sufficient for convenience of filling, but where the length approached or exceeded 20 ft. it was found desirable to have a door at each end. In some cases landing-stages were built for convenience in filling, but it was found desirable that these should be movable so that they could be dispensed with at shelling.

A modification of this type of crib has arisen through a desire to reduce expenditure. The sides in this case are vertical, being constructed of saplings spaced at 4 ft. intervals with longitudinal battens to support the wire netting which is used to line the crib. The roof is of the lean-to type. This is perhaps the least desirable of all types when storage is required for long periods, as losses due to birds, mice, &c., are considerable; but where shelling follows harvesting within a

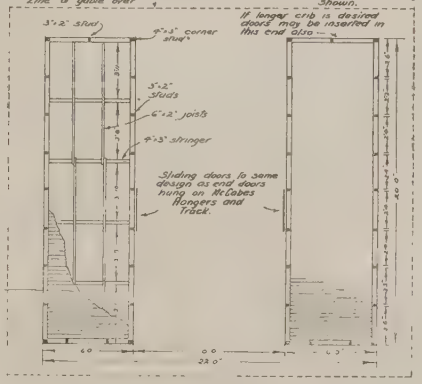


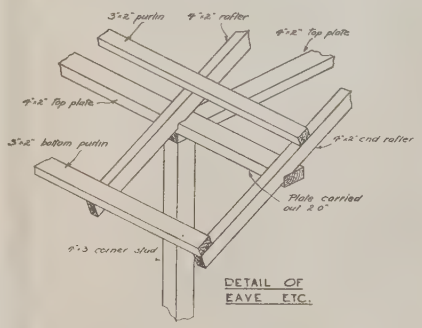
Note. Totara or Purlin posts may be substituted for jack studs and blocks shown.





Tin rat-shields similar to this may be placed over all jack studs if required


Line of gable over
If longer crib is desired doors may be inserted in this end also
3"×2" stud
9"×3" corner stud
3"×2" studs
6"×2" joists
9"×3" stringer
Sliding doors to same design as end doors hung on McLabes Hangers and Track.
Flooring cut away to show stringers and joists
22'-0"
FLOOR PLAN
Scale ⅛" equals 1 foot



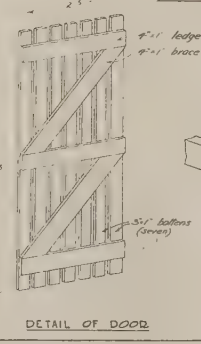
ESTIMATED CAPACITY OF CRIBS

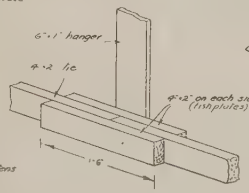
The cribs have an estimated capacity of 1800 bushels in the end, sufficient for a 30 acre block yielding 60 bushels per acre

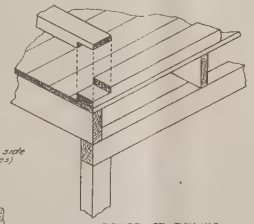
QUANTITIES & ESTIMATED COST OF MATERIALS ONLY
(COST OF LABOUR NOT INCLUDED)
Rate is a fair average for Auckland Province but requires amending to suit locality.

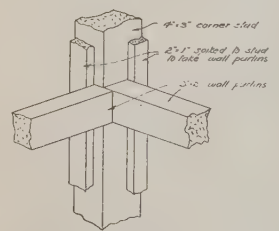
DESCR	QTY	SIZE	KIND	MEASURE CUTTING WASTE	SHORE LENGTHS	PLATE MEAS	TOTAL	RATE	
House	Blocks	0'-8"	Purifi w Tol	18"	3½ / 1'-6"		36	3/-	5 8 0
Jack	Studs	9'-3"	Rough hit Resu	1'-3"	7/16	34			
Stringers		9'-3"	do	6 0	9/16	72			
Corner	Studs	9'-3"	do	0'-9"	7/8	72			
Floor	Joists	6'-2"	do		7/8 7/8	204			
Brace		4'-2"	do		7/8 7/8	23			
Plate	Top	4'-2"	do		7/8 7/8 7/8 7/8 7/8	176			
	Sum	4'-2"	do		3/4 7/8	70			
Door	sills	4'-2"	do	8 5"	7/8	24			
Belt		4'-2"	do	12'-8"	7/8	168			
Tie		4'-2"	do	0"	7/8	80			
Tie	Tops	4'-2"	do	1'-6"	1/0	10			
Stud		3'-2"	do	0 9"	5/8	133			
Roof		2'-2"	do		250 lineal	125			
Roof		3'-2"	do		4/0 3/4	80	1095	24/0	13 9 5
Ridge		3'-1"	do		1/2 7/8	18			
Brace		9'-1"	do		9/16 1/2	45			
Hinge		6'-1"	do		1/2	33			
Door	Jib	9'-1"	do	2'-5"	1/2	12			
Batte		2'-1"	do		7/8 2	502	459	2/6	6 2 6
Post	Bo	2'-1"	do	8 5"	7/8	144	149	7/4	10 0
Floor		6'-1"	do		300 super	300	300	3/8	7 12 0
Galvanised corrugated iron - 26 gauge.					7/8 8½				11 17 0
Galvanised lead edged ridging 26 gauge 16"					½ lengths				1 10 0
Nails		2" (1 lb.); 2½" (8 lb.); 3" (6 lb.)			4" (6 lb.) Lead-headed (7 lb.)				1 2 6
Hinges		9" Black-japanned scotch "Tees"			3 pairs				1 9 6
Bolts		for sliding doors			2 pairs			TOTAL	47 16 8

Note. If ventilation through floor is required use 6"×1" boards spaced ½" apart in place of T. & G. flooring.









IMPROVED TYPE OF MAIZE-CRIB AND IMPLEMENT SHED.

Suitable for areas up to 18 acres, where crop averages about 50 bushels per acre.

To face page 306.]

short storage period, or where maize-growing is not a regular practice on the farm, it provides the grower with a cheap means of housing the crop.

On the larger maize areas, where considerable space is required, it is often the practice to build two long cribs—up to 40 ft. each in length and parallel to one another—under the one gable roof, with sufficient space between them to provide accommodation for the various farm implements. Doors for filling are usually provided at each end, with sliding-doors situated midway down the inner sides of the cribs to provide means for feeding cobs to the sheller, which is usually brought into the implement-space to allow of shelling from both cribs without having to move the machine. These cribs, which have vertical walls, are usually 6 ft. wide, 8 ft. to 9 ft. high, and from 20 ft. to 40 ft. in length. In addition to housing implements the space between the cribs promotes air-currents, which materially assist in the drying of the grain. Arising out of the foregoing type there has also been evolved a single crib similar in all respects to each section of the double crib just described.

It is claimed for this type of crib that owing to the vertical walls there is far less strain on the walls than in the case of the type with tapering sides, and consequently there is no necessity to strengthen the sides with wall supports. Furthermore, greater capacity is claimed without increase in expenditure on timber. A somewhat greater overhang of the roof is necessary, however, to protect the cobs as efficiently from the weather. Various other modifications are occasionally encountered, chief of which perhaps is the single crib built on to the back of an implement-shed; but the great majority conform to one or other of the foregoing types.

Recommended Designs.

With the object of providing information on the construction and cost of cribs embodying the most desirable features, drawings, specifications, and estimates were recently prepared by the Agriculture and Public Works Departments for the guidance of growers. Two designs were adopted: (1) A combined double crib and implement-shed, for areas up to 18 acres where the crop averages about 50 bushels per acre; (2) a single crib embodying the features of one storage section of the double type, for areas of 6 to 7 acres at a similar crop average. A copy of the first-mentioned design is presented here in reduced form. A full-size sheet of either design may be obtained on application to the Fields Division.

In explanation of the dimensions given for the cribs it should be understood that heights and widths as specified have been arrived at as the most suitable for promoting best drying conditions. Growers with considerable experience regard 6 ft. to 7 ft. as the greatest width that should be employed in any crib. In regard to height there is a greater range of opinion; but even in this respect few successful growers favour heights exceeding 10 ft.; generally 8 ft. is regarded as the most suitable. The length of crib can vary between wide limits, and will depend to a great extent on the quantity of maize to be stored.

The plans and specifications should therefore be regarded more as indicating types to which cribs should conform than as actual standard

sizes. Similarly in regard to the implement space, if greater width is desired it will be necessary to modify the plans accordingly. The estimated costs were based on rates ruling at time of compilation, and it should be noted that they make no allowance for labour.

Site and Points in Construction.

Realizing that the chief object in storing maize-cobs in a crib is to provide sufficient aeration to allow the grain to fully mature, it will be at once apparent that choice of site for the crib is of some importance. Air-currents play a greater part in efficiently drying out the grain than does warmth direct from the sun. Consequently, where it can be conveniently arranged, a site near or under a belt of tall trees would be preferred to one in the open, as direct sunlight on the grain bleaches it, thereby making it less attractive when marketed. On no account, however, should a crib be built where the soil is unduly damp, as the moisture in rising has a deteriorating effect on the grain.

It is desirable to have the floor at least 2½ ft. from the ground, so as to allow air to freely circulate beneath as well as around the crib. Rising soil-moisture can then escape easily without in some measure passing into the lower layers of cobs. The flooring itself will be more effective in promoting drying if the boards are spaced so as to allow ½ in. to 1 in. spaces between them. There will be perhaps a slight loss of grain between the boards, but this is comparatively insignificant compared with the benefit derived from the improved aeration of the lower portion of the crib.

Walls and ends should always be timbered vertically with 3 in. by 1 in. battens spaced 1 in. to 1½ in. apart to allow of aeration. In addition it is desirable, although perhaps not essential, to have the crib lined with bird-netting so as to reduce losses of grain. A gable roof is much more satisfactory than one of the lean-to type, as it is easier to provide adequate overhang with this type for protecting the cobs from the weather.

Tin shields are occasionally employed on the blocks in an endeavour to keep out rats and mice, but, owing to the fact that most cribs are not more than 2 ft. to 3 ft. above ground-level, it is doubtful whether their general use could be advocated. Rats in particular would have little difficulty in jumping from ground-level, but fortunately they are not a serious pest in most cribs in the maize-growing areas.

Openness in Cheese.—The Chairman's report to a recent meeting of the Research Council made the following reference to this subject: "At the Dairy Research Institute work is being concentrated upon open texture of cheese; but the experiments so far completed indicate that it will be necessary to resort to fundamental investigations before the cause of this trouble can be ascertained and a remedy therefor prescribed. The chemistry and bacteriology of cheese made by the newer processes of recent years have not been properly worked out, and the Institute, therefore, will be obliged to undertake further original work traversing every stage in the manufacturing process, from the production of milk on the farm to the delivery of the cheese on the overseas markets."

PACKING OF APPLES AND PEARS FOR EXPORT.

SOME FAULTS AND HOW TO REMEDY THEM.

J. A. CAMPBELL, Director of the Horticulture Division.

THE following comments are made and instructions given for the benefit and guidance of packers of fruit for export, with a view to correcting misconceptions that appear to exist and for the purpose of remedying faults in our packing system that have manifested themselves during the season, particularly with respect to the size of fruits frequently found in the maximum and minimum packs.

MAXIMUM AND MINIMUM PACKS.

Some of the unsatisfactory maximum and minimum packs of apples are no doubt due to an incorrect application of the $\frac{1}{4}$-in. variation allowed in sizing; but the majority are apparently due to a desire on the part of the packer to work off larger fruits in the maximum-size packs than the size legitimately constituting the respective pack. This is done by including in the pack a certain proportion of apples smaller than the size the pack calls for, thus making room for the inclusion of a proportion of larger ones than should go to that pack. This practice not only results in a pack faulty as to sizing, but defeats to some extent the fixing of the maximum size of a particular variety, inasmuch as it enables apples larger than regulation to be exported.

The reverse applies to the packing of minimum-sized apples. When the minimum size for Extra Fancy and Fancy grades stood at 234 it was urged that this limit excluded many $2\frac{1}{4}$ in. fruits, by reason of the fact that it took $2\frac{1}{4}$ in. with a considerable proportion of larger apples for a 234 pack to properly fill a bushel export case. As an offset to this contention it was claimed that were the next smaller pack allowed—namely, 252—apples decidedly below $2\frac{1}{4}$ in. would be packed. This was refuted by those advocating the 252 pack, and in support of this contention measured apples of $2\frac{1}{4}$ in. were packed as a demonstration, and it was claimed that 252 of these adequately filled an export case.

In consequence of this the minimum size for the grades referred to was reduced to a 252 pack. Unfortunately, however, the contention that such a pack would result in apples appreciably smaller than $2\frac{1}{4}$ in. being included has been amply verified. Growers in the main are abandoning their original argument that their desire for this pack was to get rid of their $2\frac{1}{4}$ in. apples only, and have fallen back on the count together with the sizing privileges of a $\frac{1}{4}$ in. variation. Thus if $2\frac{1}{4}$ in. apples pack 252, the actual range of sizes permissible in the case according to the variation of $\frac{1}{4}$ in. in our sizing regulations is $2\frac{1}{8}$ in. up to $2\frac{3}{8}$ in. This rendering of the situation is detrimental to our packing standards, but unfortunately the trouble does not cease there, for undoubtedly some growers wilfully employ this pack for the purpose of using up their smaller apples, effecting this by including apples considerably larger than $2\frac{1}{4}$ in., thus making room for apples considerably less than $2\frac{1}{4}$ in. In fact, apples 2 in. and under are not uncommon in these packs.

To overcome the position that has arisen the following procedure will in future apply: The existing variation of $\frac{1}{4}$ in. sizing will stand,

but in all cases of maximum and minimum packs such variations must be upward, not downward. In other words, the size of fruit indicated on the packing chart in connection with any maximum or minimum will be taken as the correct size for the pack, and no fruit of a smaller size—reasonable allowance for error excepted—must be included in the pack; any variation must be toward a larger rather than a smaller sized fruit. For instance, a 252 pack requires a $2\frac{1}{4}$ in. apple, consequently (reasonable allowance for error excepted) no apple of this pack must be smaller than $2\frac{1}{4}$ in. On the other hand, a 96 pack requires a 3 in. apple, consequently where 96 represents the maximum-size pack no apples less than 3 in. in size must be included in this pack, plus, of course, reasonable allowance for error in sizing.

The foregoing, where applicable, also applies to the packing of pears.

Faulty Bulges.

Then there is the matter of faulty bulges in connection with the full-sized export case. Too great a percentage of these are coming forward with the bulge almost entirely confined to the top of the case. Apart from advice given by local officers, this fault has been publicly referred to on several occasions. It is not sufficient for a packer to wrap and methodically but lightly place the fruit in the case. It is true that fruit requires to be carefully handled, consequently this method of packing is to be commended; but when the case has been half-filled the contents should be firmly pressed down and consolidated in such a way as to bulge the bottom boards, and the same procedure should follow when the packing of the case has been completed.

A lightly packed case with the last layer of fruit almost wholly above the level of the sides of the box, if sent forward to the nailing-press in this manner, must be termed a faulty pack, for not only are the apples of the top layer likely to be cut when the pressure of the lidding-machine is exerted, but the flexibility of the lid is such as to cause it to fall into place before the contents of the case have been properly adjusted, leaving a big bulge on top and a small one on the bottom.

Our present export case has been designed so that the top and bottom boards, while sufficiently rigid to hold the contents of a properly packed case firmly in position, are flexible enough to bend into position without undue injury to the fruit. Were the top boards stiff enough to adjust under pressure the contents of a case packed as previously indicated, so that the bottom boards would be sufficiently bulged, they would be too rigid for the welfare of the fruit. As it is, the adjustment of the lid in the nailing-press cannot be relied upon to equalize the bulge unless previously assisted by the packer in the manner indicated.

In view of the fact that a reasonably equal bulge between the top and bottom of a packed case is readily secured with a little care, and that unequal bulges are objectionable from several points of view, officers of the Agriculture Department at the various inspection points will in future withhold all such faulty cases submitted for export until readjustments have been made.

It is well to note, further, that when fruit-cases are being made up, if there is any noticeable difference in the flexibility in the boards intended for tops and bottoms, the more flexible should be used as bottoms.

EMPIRE WOOL SURVEY.

REPORT BY DR. NICHOLLS ON NEW ZEALAND CONDITIONS.

It will be recalled that Dr. J. E. Nicholls, of Leeds, visited New Zealand last year in connection with a survey of conditions of wool-production within the British Empire, and furnished a short preliminary report to the New Zealand Wool Research Committee, which was published in this *Journal* for April, 1929. The first part of a general interim report, dealing with New Zealand, has recently been issued from Torridon by the British Research Association for the Woollen and Worsted Industries.

In his introduction Dr. Nicholls makes the following explanation: "It will emerge in the report that the attitude of mind preserved throughout has been that which considers the foundations of the industry as a whole resident in the live animal, and that wool, as used in manufacture, is the product at a particular moment of a set of phenomena which are in continuous progression. This results in a fundamental difference in point of view between producer and utilizer, but it is hoped that a common realization of each other's problems will result in progress in the industry as a whole. Further, it is this attitude which has been instrumental in giving rise to this present survey and which has influenced the form of this report."

The report deals with various aspects of the pastoral industry of the Dominion, much of the ground traversed being familiar locally and not calling especially for quotation. Extracts are made here of sections treating of the stud flocks and the wools of New Zealand respectively. The latter section may be regarded as the most suggestive part of the report for our wool-growers. In regard to the flocks, it will be noted that Dr. Nicholls uses the statistics for 1927; there has been no very material change, however, in the relative positions during the two subsequent years. The matter indicated is as follows:—

The Stud Flocks of New Zealand and the Breeding Centres.

The animals from stud flocks influence in time the general standard of the various breeds, and although perhaps the majority of breeders do not use stud rams they are indirectly dependent upon the stud breeders for the quality of their stock and any improvement which may be effected. The 1927 figures record that of the total number of sheep in the Dominion 365,094 were stud sheep entered in the flock-books, 6,759,713 were sheep of a distinctive breed, but not entered in flock-books (including 1,229,346 half-bred merinos), and the number of crossbred and other sheep was 18,524,209. It may safely be said that most of the rams used in ordinary flocks came from the rank of the "sheep of a distinctive breed but not entered," and particularly among the smaller farmers, the breeders of stock for the fat-lamb trade, the indiscriminate use of rams of inferior type is prevalent, and general improvement of the standard of stock in the country could best be attained by education, by demonstration, to the use of higher-grade rams.

The general types of stud sheep may be briefly discussed in the order in which the breeds are recorded in the Official Year-book, 1928.

Merino stud sheep numbered 29,971 in 1927, being confined almost entirely to the South Island, particularly Marlborough, Canterbury, and

Otago. The stud flocks have been built up chiefly by the use of stock from Tasmania, New South Wales, and South Australia. In more recent years the demand for a bigger, hardier sheep has tended to discourage the use of Tasmanian stock and to encourage importations from South Australia. The type generally favoured is that with a good conformation and carriage, comparatively little " development " or wrinkles, with face fairly free from wool to lessen the possibility of snow-blindness, and with a dense, uniform fleece with a plentiful output of yolk. Merino sheep other than studs numbered 1,005,807.

The sheep of British extraction in New Zealand have generally been developed on rather different lines from their prototypes in Great Britain. Except in the case of the Romney, they are usually bred for the purpose of providing rams for crossbred-lamb production. Particularly in recent years they have been selected in the direction of low-set bodies of good mutton conformation, and always attention has been paid to fleece characters in order that good saleable wool may be shorn from the breeding-stock. One reason for this has been that, even where crossbred flocks are concerned, if it were necessary to keep lambs over for a season the value of the wool has been recognized as of distinct importance. Another reason is that a definite wool-breeding tradition exists generally. It may be noted here that this is one direction in which the fat-lamb industry has tended to lower the standard of quality in commercial flocks; the most profitable lambs are those which mature most quickly, the best lambs are sold off in the earlier drafts, and the stocks which are held over are usually of the " cull " class. It is, however, noticeable that in the case of those breeders who do not rely entirely upon " flying-flock " ewes for their breeding-stock (they are increasing in number) they are tending to select for retention in their flocks the best of their ewe lambs irrespective of their immediate monetary value as fat lambs.

The Lincoln sheep in New Zealand are more compact, shorter-legged sheep than those found in Great Britain. Their fleece is dense, and they have been kept in large numbers in certain areas, particularly of the North Island, where clearing of bush country has been in progress, their strong wool being found to resist the wear-and-tear from bush and scrub pulling off the fleece. It was found, however, that great difficulty was experienced in rearing the hoggets, and this breed has now been largely displaced by the Romney. There were in 1927 10,520 stud Lincoln sheep and 84,482 other.

Numerically the Romney is the most important breed in the Dominion, with 112,002 stud sheep in the North Island and 52,344 in the South Island, and with 2,881,358 " not entered " sheep in the North Island and 429,611 of this class in the South. Romney Marsh sheep were among the early importations, and the most famous flocks are descended from one established in the Hutt Valley, near Wellington. With frequent importations of Kentish stock the present flocks have been built up, although the present New Zealand types differ considerably from the English type. A low-set active sheep with a lighter bone, wide shoulders, and well-sprung ribs has been developed, and a great deal of attention has been paid to the fleece, its density having been increased and careful selection practised in most stud flocks to reduce the extent of the coarse-woolled areas on the britch and to eliminate kemp. In the North Island there is some controversy as to the merits of the east-coast and west-coast types, as developed in the Wairarapa and Feilding districts respectively.

Generally speaking, the Romney in New Zealand is called to fill many parts and to graze on a wide range of pastures, with the result that different types are favoured in the different localities. The districts of Hawke's Bay and Poverty Bay may be mentioned, the latter district providing large numbers of draft ewes which are sent to Canterbury for use as the dams

of crossbred fat lambs reared on the agricultural plains; and Southland, where the Romney is depastured on the high, wet hills. The purebred Romney lamb matures rapidly and is in good demand for the freezing-works, while aged and cull Romney ewes mated to Southdown rams produce excellent fat lambs.

The variety of habitats occupied by the Romney has resulted in the stud breeders being forced to maintain in their flocks a number of types both of conformation and of fleece character, the breeders in the different districts demanding distinctly different kinds of body and of fleece; while a result of the rapid increase in numbers of the breed has been that drastic culling has not taken place, so that a wide range of variation can be found.

The Border Leicester breed has a numerical strength of 24,411 studs and 69,405 others, the majority being in the South Island. Rams are in good demand, particularly for crossing with Romney ewes to yield a valuable mutton animal maturing more slowly than the Romney and Down types, and therefore meeting a later market. The fleece has been increased in density and fineness, and particular attention paid to the belly wool.

The English Leicester breed was introduced early, and the first cross with the Merino formed the famous "Canterbury mutton" sheep of last century. Its use has now diminished, only 20,402 stud and 55,410 other sheep being recorded, the great majority of these being found in the South Island. The type favoured was again a smaller lower-set sheep than the English type, with a denser fleece, a finer head, and a lighter face. In recent years some breeders have, with importations of British stock, tended to approach the British type, and it is suggested that this has to some extent assisted the decline in popularity.

The Shropshire has declined in popularity, the dark face and the size being objected to by breeders: the 1927 figures record only 4,834 stud and 17,555 other sheep.

The Southdown is increasing greatly in numbers all over the Dominion, there being in 1927 36,630 stud and 79,836 other sheep in the North Island, and 17,420 stud and 16,266 others in the South Island. The type favoured is that popular in England, although there is a tendency to grow a larger frame in certain districts. The distribution of flocks is widespread, and it would seem that some localities are not entirely suited to pure Southdown flocks, trouble being experienced with the lambs and hoggets, which show susceptibility towards foot-scald.

The Corriedale—the inbred half-bred of several derivations, but with the Lincoln strain predominating — provided in 1927 49,841 stud sheep and 886,307 not entered in the flock-book towards the total sheep population of New Zealand. Comparatively few are found in the North Island. This breed is of peculiar interest in that it is the result of a great piece of constructive breeding, and that it serves as an illustration of many points which must be considered in sheep husbandry. As in the case of the Romney, there has been a rapid increase in numbers, with resultant low culling of breeding-stock generally, and at the same time it is largely the case that the important centres of stud breeding are on low land and much improved country. Flocks are also being tried out on country too hilly, too high, or too lightly vegetated. It would appear that the formative period of the breed has been obscured by its popularity. The Corriedale would provide excellent material for a genetical study of fleece and body characters when our methods of analyses of these have been developed.

The remaining breed recorded separately in the 1927 figures is the Ryeland, which is of recent introduction. The breeders of the 3,354 stud and 1,888 other sheep are devoting considerable care to the selection of stock

with dense fleeces free from kemp, and the staple showing a good crimp with few cross-fibres. Some breeders are experimenting with Ryeland-Romney crosses for breeding purposes.

The Wools of New Zealand.

New Zealand wools generally possess good lustre and are light in condition. As previously noted, features in the history of wool-production have been the decrease in Merino, a subsequent decrease in half-breds, and later increases in Corriedales and Romneys with other longwools and cross-breds. Opportunities have been secured of examining wools of most of the New Zealand breeds on the sheep, and several defects or weaknesses which are of interest to the breeders may be discussed, together with aspects of their production of interest to the manufacturer.

In the Merino the development of a stronger constitution has been generally accompanied by a broader or stronger wool; the use of South Australian stock has aided this, and few Merino wools now show the old Tasmanian dark tip. Also, a very dense fleece is not in high favour in many of the wetter districts, owing to the difficulty in drying a dense fleece once it is thoroughly wet. The reduction in extent of wrinkling has perhaps assisted the breeders in the selection of the stock with fleeces showing little variations in fibre-diameter between the crests amd troughs of the folds, but possibly more attention could be paid to this point. Owing to the severe weather conditions experienced in many districts the wools may appear "ill nourished," with weak tips, with little flow of yolk; in certain seasons following rains great discoloration in the fleece may follow. Also in certain districts—*e.g.*, in Canterbury—the fleeces, particularly the necks and backs, may contain a large amount of sand and shingle material blown into the fleece in windy weather in dry seasons when the sheep are camped in the river-beds. A defect which has been noted is a tendency, in many animals, for the fleece to become open, short in the staple, and tender on the top of the shoulder.

The Corriedale breed has many interesting features; its fleece characters have received particular attention from the breeders, who have striven to preserve the good qualities of the half-bred type of wool. The breed has, however, been called upon to occupy a variety of habitats, with the result that natural conditions, in cases unsuitable to the breed, have exerted an antagonistic effect. For instance, under hard conditions of high hill country the fleece tends to decrease appreciably in weight, to lose density, and to break down generally; again, on limestone country the wool tends to exhibit an undesirable harshness of fibre. Whether or not this is due entirely to the kind and supply of nutritional elements or is in large part due to breeding is a point to be investigated. Indeed, a criticism which may be made generally of Corriedale wool is that harshness, possibly associated with a lack of elasticity, exists. It would appear also that animals from the Lincoln-Merino foundations are more liable to this character than are those derived from Leicester-Merino ancestry. Further, though the leading breeders have selected for evenness in quality over the body, a great variation exists in this respect in many animals. It may be that the widespread occurrence of this is due in part to the rapid increase in numbers of the breed and its breeders. The successful establishment of a definite crimp in many flocks has not been extended to the majority; many cross-fibres exist, the fleece does not open freely, and there is a tendency for the fleece to break down along the lines of "short shed" separating "fleece wool" from "belly wool." A point to which attention may be drawn is the occurrence of a mosaic arrangement of coarse and fine fibres even in the finer regions of the fleece. Kemp is also of fairly frequent occurrence, even on the rump and back. It must be remembered that one

of the reasons for the establishment of the Corriedale breed was the desire for a good-woolled sheep; and particularly at the present time, when improved pastures have become general, with consequent better nutritional conditions in the lower breeding-areas, it is even more important that the production of good sound wool *which will not break down under less favourable conditions* should be the first consideration of the breeders of stud and flock rams.

Among the wools of the crossbred types most opportunities have been presented of studying the Romney breed and its crosses. In the course of these studies certain characters of the fleece which could be subjected to general improvement have been noted; it should, however, be clearly appreciated that until the precise nature of the development of these characters is more fully understood the task of improvement must proceed in only a superficial way.

The value to the breeder of the fleece is made up of the products of length, density, fleece area, and uniform distribution of the characters of manufacturing value. (To these may be added protective value.) The breeders' difficulties have lain in the lack of information as to the interrelations of the various characters and their respective values in the ultimate use of the products.

To consider briefly some of the obvious characters involved, bearing in mind that few of these points raised have been critically and scientifically examined as yet:—

(*a*) *Extension of Fleece and the Kind of Face and Leg Covering.*—The greater the body area the more wool produced, other things being equal. The breeders like, under certain conditions, the fleece to be extended on to the poll and well down the legs and to be carried well on the abdomen. Some of these areas are, however, those which can be considered as normally hair-producing, and the presence of hard, coarse hair on the face and legs, in contrast with smooth hair, is usually associated with the presence of kemp or hair in the fleece, and also of harshness in the wool. Also, if the "wool" fibres growing on the head, neck, ears, and legs are found to be weak, irregular, and short, this is taken to indicate, from experience, that the fleece will most probably break down with age, becoming less dense, less extended, and particularly weak on the rump, back, and abdomen in later years.

(*b*) *Density.*—Generally the breeders have selected for greatly increased density, neglecting other characters of the fleece. While there is a general association between increased density, decreased length of fibre, and smaller average diameter of fibre, it may be that an optimum density exists for the production of sound, well-grown wool. In other words, it may be suggested that for a given breed there is an optimum amount of "fibre stuff" which may be produced in any particular season, depending upon inherited tendency and nutritional effects. Again, it would seem from microscopic inspection that density may be expressed in different forms: the fibres (the follicles) may be regularly distributed or may be clumped together. The latter arrangement may give rise to irregularities in average diameter between neighbouring groups of fibres.

(*c*) *Average Fineness of Fibre, Length and Uniformity of the Fleece.*—The uniformity of the fleece has been a great concern of breeders, who have, for the majority, selected against obvious coarseness or "hairiness" of the britch. (There is, however, great room for improvement in this respect in the flocks of New Zealand generally.) The subject is complicated; the regional differences in fibre-diameters may possibly be associated with differences in skin-thickness or vertical distribution of follicle groups within the skin. Further, a difficulty is experienced, particularly in the Romney, in keeping "weak" patches off the backs (at the shoulders and rump) and

on the flanks—the wool of these areas being irregular in length, average diameter, and strength, and often giving rise to a " tailly " appearance.

Average fineness must be considered in close association with length, and with its variation in time and structure. Generally speaking, the coarser fibres are longer, include medulla in their structure, and are apparently less elastic ; but if such coarse fibres are grouped together in the fleece they can be removed in sorting. However, it is found quite commonly that coarser fibres are mingled with finer fibres, and this apparently forms a much more serious defect, presenting more difficulties in eradication or amelioration. In some individuals the mixture of long, coarse, and short fine fibres may produce the appearance of two coats of fibres on the animal ; in the great majority of animals examined it was possible to find, even on the shoulder areas, neighbouring fibres widely different in diameter throughout their lengths. It would seem that this defect is genetical in nature.

Observations also suggest, as in the case of density, that there may possibly be an optimum condition of average fineness in individuals ; if, for instance, owing to general or specific deficiencies in nutritional conditions (*cf.*, the familiar " hunger fine " condition) this fineness is exceeded, then general weakness of fibre results (unsound, tender wool).

In another direction the question of average diameter and structure is important ; in New Zealand wools a frequent defect is the existence of " thickened tip "—this condition occurring in adult fleeces and being distinct from the lamb coat tip, and being more noticeable in the longwool breeds. The expression of this condition varies greatly, and would seem to bear a definite relation to the time of shearing and/or the nutritional conditions immediately succeeding shearing, as the part of the fibre affected is that formed during the period just after shearing. The reactions of individuals to those conditions which give rise to thickened portions of the fibres may conceivably vary greatly. Closely connected with such gradual changes in diameter and structure is the question of occurrence and intensity of breaks in the fleece.

(*d*) *Staple Formation and Crimp and the Flow of Yolk.*—Great variation exists in the character of the staple ; dense large locks are considered desirable by some breeders, while others prefer smaller locks. Similarly, in the style of crimp, a rolling wave-like crimp may have advantages over a short-phased saw-tooth crimp. In this connection the question of the flow of yolk appears, in that under the same conditions of management and nutrition certain individuals of similar breeding exhibit yolk flowing freely to the distal end of the staple, and in a general way these have soft-handling wool with an absence of " wasty " tip. The whole question of yolk formation and conduction through the fleece is of considerable importance to the breeder. Also, there may be some association between cross-fibres (fibres which do not conform in disposition to the general staple or crimp formations) and the undesirable character of harshness and irregularities in the fibre-diameters.

(*e*) *Harshness.*—This is a general defect of many New Zealand wools. It can be suggested without any exact knowledge of its nature that its origin lies in the genetical constitution of the individual, that its expression may be affected by environmental or nutritional conditions, and that its occurrence is apparently related to other general characters of the fleece already mentioned.

(*f*) *Elasticity and Soundness.*—In respect of these characters it must be stated in general that New Zealand wools appear satisfactory, but evidence is not lacking that certain wools show a marked tendency to be defective in one or other, or both, under the slightest environmental provocation.

(*g*) *Cotting and Matting.*—Though considerable light has been thrown in recent years on the nature of cotted fleeces, it is evident that the predisposing causes are not fully understood. This condition is particularly

common among New Zealand longwool sheep. It may be connected in its smaller degrees of expression with harshness of fibre, presence of crossfibres, and a restricted rise in the yolk.

This list is by no means exhaustive. Reference has been made to these points only because they are those which would appear to be of most immediate importance to the producers of New Zealand, and those in which improvements must begin in the hands of the stud and leading flock sheep breeders.

Education and Research.

Dr. Nicholls appends a special report on education and research affecting the wool-producing industry in New Zealand, which is here quoted in full as follows :—

Repeated criticisms of New Zealand wools in the press have directed the breeder's attention to the fact that all is not well with his wool. Quite apart from the question of how far many of these criticisms are justified and how far they may have originated in a lack of sympathy between those who buy and those who sell, the position has been reached that, generally speaking, the breeder is peculiarly anxious to improve his wool products. He has, however, been prevented by the lack of precise information which may be of assistance to him in his breeding methods and procedure. This information can only be made available by education in those principles which have been established by research.

Until recently the educational field has been occupied by instruction in wool-classing and preparation of the clips for sale, by the instructors of the local educational authorities in technical schools, and by courses to the students at the Lincoln Agricultural College and at the farm schools, who have had the advantage of practical work in shearing and handling wool. The Department of Agriculture has a sheep and wool expert who is available for advice to farmers, and who has conducted instructional classes for farmers at various local centres ; at these classes also lectures have frequently been given by individuals who have made a study, in their private capacities, of New Zealand wools. These lectures and demonstrations have produced excellent results in focussing the minds of the breeders on particular points in breeding sheep for wool-production ; but it can be stated with some assurance that information desired by the breeder has only in part been provided. Lately the Massey Agricultural College has secured the services of a zoologist with experience in wool research, and a research programme has been embarked upon.

It would seem that an educational system whereby the breeders could have access to the latest information on scientific work conducted in other wool-producing countries should be established. There is a genuine feeling that rapid improvements could be made in the general standard of the clip if the defects in stock, preparation in wool, &c., could be pointed out to the breeders as a community. This would involve, for early results, the instruction, preferably by demonstration, of the present generation of breeders. The question of the personnel of such a system is difficult. It is recognized that further information can only be obtained by further careful research, and it is suggested that both services would be handicapped if the research workers were called upon to conduct extensive lecture campaigns and demonstrations.

New Zealand would appear to be particularly suited to the conduct of research investigations upon wool ; many breeds, many sets of environmental conditions, and the enthusiastic support of the breeders add strength to this view. At the same time it is questionable whether the Dominion can afford a complete research institution in which all the different aspects

of sheep-breeding can be contemplated and the character of the clip in relation to its manufacturing uses be examined. The study of wool-production must be closely identified with the consideration of mutton and fat-lamb production, since sheep husbandry in the Dominion is organized towards exploitation of the dual capacity of the sheep. In this direction the study of the sheep must be conducted in close association with workers engaged upon the pastures, soil, and other problems of the country. It would seem that general empirical experiments on the profitable type of husbandry for given districts is urgently required, and economic study of the conditions of production, particularly in the good wool districts.

In wool-production the breeder is called upon to strike a balance of those characters in his fleece which are of manufacturing value with the characters which he can most readily cultivate and maintain in his flock on his own particular land. Assistance can only come from close co-operation with institutions engaged in the study of manufacturing conditions and problems, so that the breeder may be aided in his attempt to balance the characters concerned by the correct weighting of their values to him.

It is also important that those persons who are to conduct the research on the production of New Zealand wools should have a training sufficiently comprehensive to enable them to work with a perspective realizing the position of their raw materials in relation to the industry as a whole, and also in such contact with work in progress in other countries and institutions that they may more readily be able to view their own problems in the light of other experience. Again, the question of personnel presents itself. It is suggested that—

(1) Immediate steps be taken to secure the co-operation of the British Research Association for the Woollen and Worsted Industries in the examination of New Zealand wools by the techniques already established and in the light of work conducted in other countries.

(2) Immediate steps be taken to extend the training of post-graduate research workers in the field of agriculture, zoology, and genetics into the fields of wool research by means of scholarships or fellowships to the above institution for periods of not less than two years, with guaranteed employment on completion of training.

(3) A provisional appointment be made of an officer to visit that institution and familiarize himself with work in progress and the uses of New Zealand wools in manufacture, and to act subsequently as a field liaison officer in New Zealand with that institution and the New Zealand students in training.

(4) Until the training of the above work is complete no definite scheme be embarked upon for the establishment of any actual sheep-breeding research institution.

(5) The work already in progress in New Zealand be encouraged, and that field demonstrations of the economic aspects of wool and meat production be undertaken.

(6) The establishment of a central institution of similar constitution to that of the Dairy Research Institute be contemplated, it being desirable that research on sheep-breeding should not be allied to or obscured in relation with educational institutions or programmes, and should be conducted in an organization with independent control of its experimental material. Such an organization would serve for co-ordination of effort, as the depository of information, with definite powers of co-operation with bodies such as the British Research Association, and as the advisory nucleus in educational campaigns.

SOME NOTES ON STARTERS FOR CHEESE-MAKING

J. B. SAWERS, Dairy Instructor, Palmerston North.

To any cheesemaker following closely the work it must have become apparent at some time or other that it does not necessarily follow that because cooking-temperatures and acidity are the same with different starters the cheese will show the same degree of acidity. Cases are known of starters doing good work at one factory but failing to show much of their vigour at another, yet where a starter known to be clean by a bacteriological examination was taken to another district good results were obtained.

It appears to be fairly common in most districts for cheesemakers to obtain starters from one another. While this practice in some cases is sound, it does not tend to improve the vitality of starters as a whole, especially when such starters may be contaminated. While much care and attention has been and is being given to the daily propagation of starter, there still remains room for further advancement by giving stricter attention to the daily propagation of mother starters, especially when a fresh starter has been obtained from a reliable source.

Practical cheesemakers are fully alive to the necessity for obtaining absolutely clean fresh milk for the making of starter. With a view to making sure that the milk attains such a standard, curd tests could be made or samples submitted to the reductose and fermentation test. Extra care could be given along the line of making sure that the milk used for the daily propagation of the mother starter was kept as free from contamination as possible. Pasteurizing and cooling in a separate vessel or container would ensure this to a large extent. By such treatment a higher pasteurizing-temperature would be more quickly obtained and cooling be more rapid. Such a procedure would afford a more reliable method of obtaining suitable milk for the propagation of a new starter from a culture of lactic ferment.

Good results can be obtained by pasteurizing half a gallon of fresh milk at a temperature of about 190° F. for one hour and a half, then cooling down to 100° to 110°, at which temperature the milk is held for one hour before pasteurizing again at a temperature of 190° for one hour. The milk is then cooled to 85° as quickly as possible and the culture powder added, the temperature being maintained until coagulation has taken place. Should there then be any danger of acidity developing too far the culture can be cooled down.

The milk could be pasteurized in the same manner for the second and any further propagations desired, until such time as the starter was ready for general use.

It is a well-known fact that a starter if allowed to become overripe loses its vitality. Hence the necessity for guarding against this by keeping the starter at an even temperature and using only the minimum amount of culture required to have sufficient acidity

developed at the particular time it is required for use. This treatment is also essential in the case of the mother starter, for on its condition the ultimate success depends.

The maintenance of a good starter depends not only on the selection of suitable milk, but on the care exercised from day to day to prevent it becoming contaminated with undesirable germs. A steam sterilizing-oven into which all utensils used in this connection may be placed and thoroughly steamed for an hour or more is to be strongly recommended. Many of our dairy companies could with advantage go further and have the sterilizing-oven of such larger dimensions as would accommodate all the smaller factory utensils.

FLUE-BARN CURING OF TOBACCO-LEAF.

A STANDARD DESIGN AND NOTES ON METHOD.

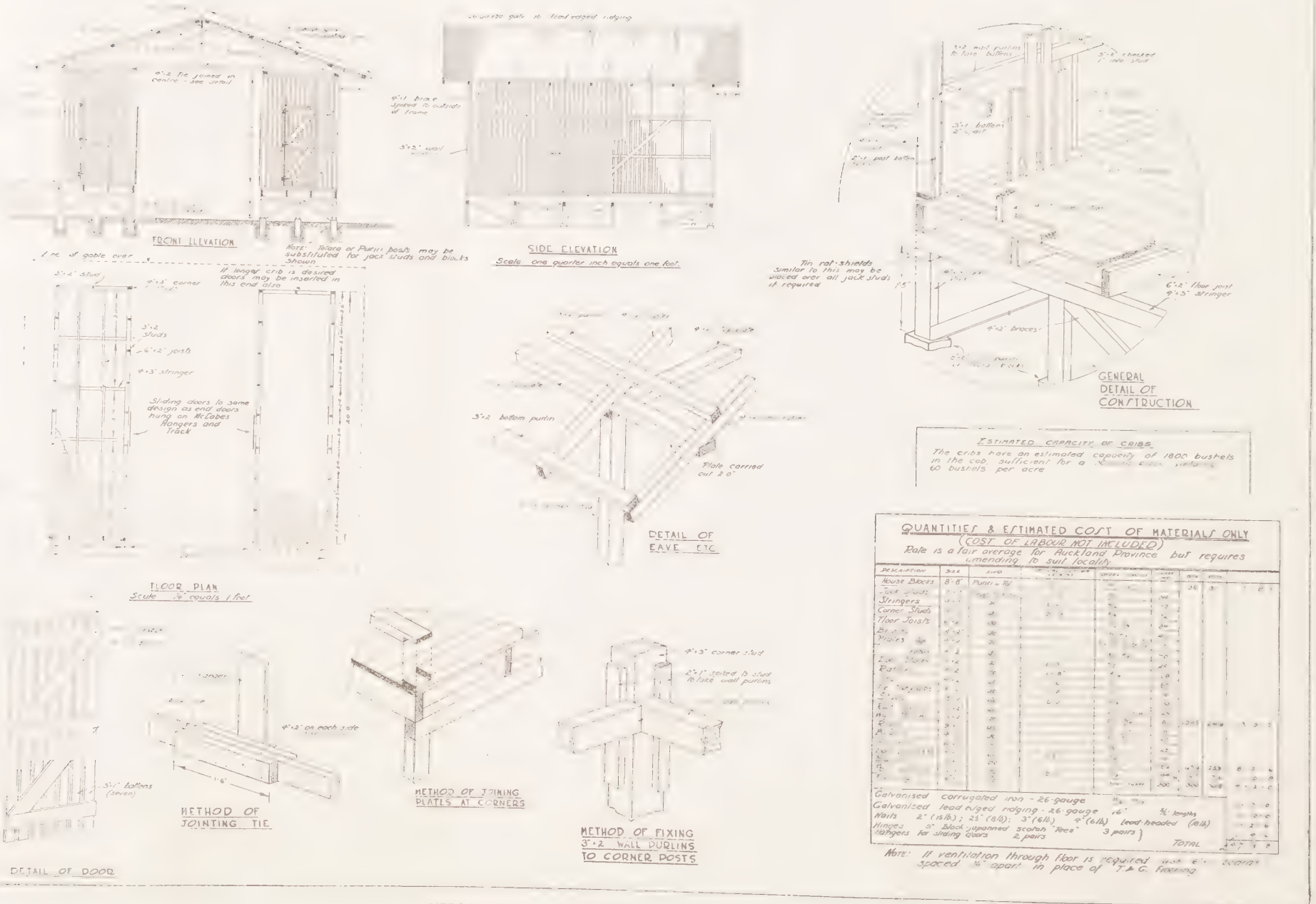
C. Lowe, Instructor in Tobacco-culture, Horticulture Division.

As a rule, flue-barns for tobacco-curing are built to a standard size—16 ft. by 16 ft. inside measurement, and 20 ft. to the eaves—the reason being that the manner and methods of curing are the same throughout all tobacco districts. Any alteration in dimensions makes necessary an entirely different system of temperatures, amount of fuel, and times of processing; further, the size stated represents the most convenient capacity. The accompanying plans give all the dimensions and show internal fittings. Full-sized copies may be obtained on application to the Horticulture Division.

The roofing recommended is of malthoid or ruberoid tightly fastened upon closely timbered sarking; this is to make the chamber airtight and to prevent condensation of moisture. Iron roofing is not advised, as it is very difficult to make it airtight, and the drip from condensation is very bad at certain stages of the process. Windows in the structure are not recommended, as light—particularly sunlight—has a bad effect upon the colour of the leaf; also, the final heat of 170° to 180° F., if it happens to coincide with a cold southerly snap, is liable to break all the glass and cause great inconvenience and damage at a critical time. As indicated in the elevation drawing, the walls are constructed of poilite sheets over ordinary studs.

The process of curing tobacco-leaf in a kiln is shortly as follows: The barn is filled with 850 sticks of leaf, each stick carrying twenty-two bunches of three leaves of average standard size, 12 in. to 15 in. long, or two leaves 24 in. to 30 in. These sticks are placed about 8 in. apart on the tier poles. The leaf should all be uniformly ripe. The fire is started in the furnace and kept low to maintain a heat of 90° to 92° F. for thirty-six to forty-eight hours, with all vents tightly closed. This forms a saturated atmosphere if the leaf is freshly gathered and full of sap. A hygrometer is used to record the amount of moisture in the air, and a difference of 3° between wet and dry bulbs is correct.

When the leaf in the barn has turned a good yellow colour under these conditions the temperature is slowly raised, and requisite ventilation top and bottom is supplied to carry off the moisture as fast as it


FRONT ELEVATION
SIDE ELEVATION
Scale one quarter inch equals one foot.
Note:- Totara or Purlin posts may be substituted for jack studs and blocks shown.
GENERAL DETAIL OF CONSTRUCTION
Tin rat-shields similar to this may be placed over all jack studs if required
FLOOR PLAN
Scale ¼" equals 1 foot
If longer crib is desired doors may be inserted in this end also
Sliding doors to same design as end doors hung on McLabes Hangers and Track
DETAIL OF EAVE ETC
Plate carried out 2'0"
ESTIMATED CAPACITY OF CRIBS
The cribs have an estimated capacity of 1800 bushels in the cob, sufficient for a crop yielding 60 bushels per acre
QUANTITIES & ESTIMATED COST OF MATERIALS ONLY
(COST OF LABOUR NOT INCLUDED)
Rate is a fair average for Auckland Province but requires amending to suit locality
DESCRIPTION
House Blocks
Galvanised corrugated iron - 26-gauge
Galvanized lead edged ridging - 26-gauge
Nails
Hangers for Sliding Doors
TOTAL
Note:- If ventilation through floor is required
DETAIL OF DOOR
METHOD OF JOINTING TIE
METHOD OF JOINING PLATES AT CORNERS
METHOD OF FIXING 3"×2" WALL PURLINS TO CORNER POSTS

IMPROVED TYPE OF MAIZE-CRIB AND IMPLEMENT SHED.

Suitable for areas up to 18 acres, where crop averages about 50 bushels per acre.

[To face page 306.]

is given off by the leaves. No tobacco-leaf will stand sudden changes at this period, and 2° an hour is the maximum raising-point.

When the blade of the leaf is dry at a temperature of 125° the barn is "fixed," after which all danger is over, and heat can be advanced and ventilation increased. There are no hard-and-fast rules to follow; everything depends upon the experience and understanding of the man in charge. Also, barns in different localities and leaf produced under the various cultural conditions have a great influence upon the method to be followed. Another point to be remembered is that as the curing-season advances and the leaves are gathered from higher up the plant-stalk the management of the barn has to be varied. Again, curing in a dry hot season is quite different to the method followed in the wet cold weather. Good curing is thus only possible when undertaken by one who has had some experience.

A flue-barn chart is supplied by the Horticulture Division on request, but it should be borne in mind that this chart deals with the first curing of the season. Lower lug leaves, uniformly ripe, are usually cured in dry weather about the first week in February. The cultural methods bestowed upon the tobacco have an immense effect upon the curing methods in the barns. Insufficient cultivation between planting and topping tells a sad story at curing-time. The application of too much nitrogenous manure produces large heavy leaves that will not respond to yellow-leaf curing methods. Again, too long a time spent in filling the barn—say, several days—gives bad results. However, with care and skill it is possible to cure a whole season's crop, even under wet-weather conditions, and produce 90 per cent. of bright yellow leaf.

The difficulties that are to be encountered in flue-barn curing have been mentioned so that those who are considering the matter may not enter upon it lightly, thinking that the erection of a flue-barn is the sum total of the matter. Careful application and attention to the small details are of vital importance in this work.

A flue-barn charge takes from four to five days to process. This, with one day to fill and another to empty, makes an average of a barn a week, which can be reckoned on with a season of about seven weeks' curing.

The tobacco from the flue-barn is removed to a bulking-shed, where it is bulked down upon the sticks—shingled in long rows or built in 4 ft. squares 12 ft. high. It mellows, and the colour improves during the three weeks of bulking. It is then ready for packing. Care should be taken that no tobacco is packed under pressure in cases with the leaf containing less than 12 per cent. or more than 14 per cent of moisture.

Ensilage and Dairy Cows.—In connection with the concluding article on temporary sterility of dairy cows in the March issue of the *Journal*, the writer, Mr. J. Hill Motion, wishes to remove any wrong impression readers may have gained as to his views on the winter and early spring feeding of ensilage. In a note on the matter he states: "The importance of ensilage as a winter feed for dairy cows has been well established in New Zealand. This method of pasture utilization is one which I would strongly urge in connection with the feeding of our dairy herds."

OUTDOOR CULTURE OF TABLE GRAPES.

SOME RECOMMENDED VARIETIES.

J. C. WOODFIN, Vine and Wine Instructor, Horticulture Division.

MANY people are under the impression that grapes can be grown successfully outdoors only in hot climates, being unaware that the grape is really a fruit of temperate climates, and that extremes both of heat and cold are unfavourable to the development of its highest qualities.

There are over five thousand varieties of grape-vines actually cultivated in the world, and among these are many kinds suitable for growing throughout New Zealand on favourable sites from Stewart Island to the North Cape. A number of these have been introduced into New Zealand from time to time by the Department of Agriculture from Europe and America, in order to test their suitability for growing under our climatic and other conditions, and some very satisfactory varieties have been selected and made available to the public. The Horticulture Division at the present time has some two hundred newly introduced varieties under observation in its experimental vineyard at Te Kauwhata, Lower Waikato district.

Not only are many varieties of vines suitable to our climatic conditions, but they come to perfection on our various soils. As a matter of fact, vines are not very exacting as regards soil, and they produce heavy crops on our poorest lands—gum-lands, light volcanic, and on almost pure sand. What struck me most about the vineyards on my arrival in this country after twenty-five years' residence in the vine-growing regions of Europe was the flourishing condition of the vines and the remarkably heavy crops they were carrying in comparison to what I had seen on the same varieties in Europe.

There is one class of land, however, which should be avoided. The vine has a strong dislike for wet feet, and no attempt should be made to grow it on swampy or wet soil before it has been properly drained. The proximity of trees should also be avoided, as the roots of these are apt to rob the soil of the vines' food. There is, however, little need to use such positions, as there is plenty of land in this country on favourable slopes facing the sun, which is now unprofitable, growing nothing better than manuka, fern, and blackberry, and which is quite suitable for growing grapes to perfection.

Central Otago, among other districts, shows great promise as a future viticultural centre. Grape-vines planted by miners in the early days are still producing excellent fruit, and in order to try the value of further varieties in the district the Horticulture Division planted a test plot of vines at Earnscleugh on the property of Mr. G. W. Marshall, who kindly placed the necessary land at our disposal. A similar plot was planted in the Moutere Hills district, Nelson, on the property of Mr. T. C. Brash, and other smaller plots are kept under observation throughout the Dominion.

The most important centre of table-grape production in the Dominion is situated round the Te Kauwhata experimental vineyard, where there are over thirty private growers who dispose of their fruit on the Auckland market and elsewhere.

One of the principal factors which renders the grape so valuable as a nutritious and sustaining food is the sugar, of which grapes contain more than other fruit in a form known as glucose or grape-sugar, which, requiring practically no digestion, is easily and rapidly assimilated into the blood. This property gives grape-sugar four times the value as a food compared with refined cane-sugar. Grapes also contain, besides valuable mineral constituents, vitamins, and fruit-acids, albuminous and fatty matters; yeasts are also present on the skin.

Table grapes can be employed for making the unfermented grape-juice which is now imported from Canada and the United States of America. Our Albany Surprise grape is equal to any American grape grown for that purpose; in fact, it is identical with the variety known as the Pierce grape, which is the best Californian variety for making unfermented grape-juice. When grapes are plentiful they can be used for making jam, jelly, grape-butter, spiced grapes, pies, pickles, and even vinegar.

Grapes grown under glass may always remain more or less a luxury, or a rather costly necessity for the sick, but outdoor grapes in season should be obtainable as cheaply as any fruit grown in this country.

By planting a succession of varieties (we have varieties ripening from early February to the end of April in our experimental vineyard) and by storing the later varieties of grapes in cool store, or in dry dark rooms, as is practised in Europe, with the stems on the bunches in water in which pieces of charcoal are placed to keep the water sweet, grapes may be preserved in good condition for months. Great quantities of grapes are stored in this manner by the growers round about Paris and other populous centres, and are forwarded to the markets as required when the season of fresh grapes is over. I believe such an industry could be created under the dry climatic conditions of Central Otago and along the east coast of both islands.

It is suggested that growers should select a sunny spot on which to plant vines—an acre or two for market purposes or a few vines for home supply. They can be planted so as to take up very little extra room, as a border to vegetable plots or along the sides of the avenue leading to the homestead. In the cooler parts a wall facing the sun could be utilized for the purpose. A good time to plant vines or vine-cuttings is during the month of August.

Table-grape Varieties recommended for Outdoor Culture.

For the guidance of intending growers, and for general information, lists of several groups of varieties are appended. It will be noticed that the varieties are arranged by ripening-periods, concerning which some explanation is desirable. The first ripening-period is that of the Golden Chasselas (Chasselas doré de Fontainbleau), which ripens in New Zealand about the end of February or the beginning of March, according to the altitude, aspect, and soil conditions of the vineyard. The precocious varieties ripen their fruit from two to three weeks before the Golden Chasselas; early varieties between the precocious

and first-period varieties; second and third periods approximately two and four weeks later than the Golden Chasselas.

EUROPEAN VARIETIES.

Precocious Period.—Black: Gamay hâtif des Vosges. White: Madeleine Alice Salomon.

Early Period.—Black: Noire hâtif de Marseille. White: Précoce de Malingre; Agostenga.

Early First Period.—Black: Portugais Bleu. White: Madeleine Royale; Goldriesling Blanc.

First Period.—White: Golden Chasselas (Salomon's selection): Muscat Salomon; Lignan. Rose: Chasselas Rose Royal; Malvoisie Rose.

Second Period.—Black: Black Hamburg; Alphonse Lavallée; Cinsaut. White: Chaouch; Gradiska; Temprano.

Late Second Period.—Muscat Hambro.

Third Period.—Black: Black Alicante; Mrs. Prince's Muscat. White: Golden Queen.

AMERICAN AND AMERICAN-EUROPEAN VARIETIES.

The pure American varieties and American-European hybrids, being more resistant to diseases, are especially suitable for North Auckland conditions; and, requiring less care than the European varieties, are very suitable for planting in the farmer's garden or orchard. Owing to their aromatic flavours, the grapes they bear are not always appreciated by those used to the delicate flavours of the European grapes; while others prefer them, as the already large and increasing demand for the Albany Surprise on the Auckland market and for the Iona in Hawke's Bay goes to prove.

Precocious.—White: Baco 2–16 (Totmur) (suitable for pergolas).

Early.—Black: Campbell; Worden. White: Siebel 5279; Diamond.

First Period.—White: Siebel 5409.

Late First Period.—Black: Siebel 4643; Siebel 5455. Red: Agawam.

Second Period.—White: Niagara. Black: Albany Surprise (suitable for pergolas); Herbert; Concord. Red: Iona; Brighton.

PHYLLOXERA-RESISTANT STOCKS.

A selection of stocks is available suitable for the various types of soil in the phylloxera-infested areas of North Auckland. Advice as to their affinity for scion varieties and their adaptation to the different soils will be supplied on application.

NOTE.—A number of recently introduced varieties of European, American, and hybrid vines are under observation in the Experimental Vineyard at Te Kauwhata, and will be released during the next and following seasons as they are found to be suitable for New Zealand conditions.

Insignis Pine for Butter-factory Construction.—A dairy company recently advised the Dairy Division that it was considering using insignis pine for heavy rafters and other work in the roofing of an extension to the factory, and inquired whether this timber, with its marked odour, might be detrimental to the cream and butter. The State Forest Service, to which the matter was referred, gave the opinion that no harmful effect would result in this connection.

THE INDIGENOUS FLORA AND VEGETATION OF NEW ZEALAND.

L. COCKAYNE, C.M.G., Ph.D., F.R.S., Honorary Botanist, State Forest Service.

FOR various reasons the plant-life of New Zealand is of peculiar interest, especially its extreme isolation from other land-masses, its flora of diverse origin but with an astonishing number of endemic species and group after group of wild hybrids, the numerous and often peculiar life-forms of its members, its having developed unmolested by grazing and browsing mammals, and its vegetation, so diversified that only a continent extending into the tropics can claim an equality.

The Flora.

The flora, considering in the first place the *Ferns, Fern-allies,* (lycopods, &c.) and *Seed-plants* (trees, shrubs, herbaceous plants, grasses, &c.) consists of about 1,848 species—including under this term a good many well-marked varieties—of which 148 are ferns, 19 fern-allies, 20 conifers (only 1 with a cone in the usual sense), 426 monocotyledons (grasses, sedges, liliaceous plants, orchids, &c.), and 1,235 dicotyledons (mostly trees, shrubs, herbaceous and semi-woody plants), and they belong to 109 families (groups of related genera) and 382 genera (groups of related species). Nearly 79 per cent. of this flora is found wild in no other land (endemic), and the remaining 392 species are chiefly Australian (236), and the balance subantarctic South American (58), cosmopolitan in a wide sense (most also Australian), Norfolk Island, Lord Howe Island, and Polynesian; while a good many of the families and genera are Malayan, which tropical element found its way to New Zealand during a great extension of its area northwards in the early Tertiary period.

The high endemism of the flora is not confined to the species, for there are 39 purely New Zealand genera, some of which are only very distantly related to genera elsewhere—*e.g., Tupeia, Dactylanthus, Pachycladon, Ixerba, Carpodetus, Myosotidium, Teucridium,* and *Alseuosmia*. The specially large families and genera, together with the number of species each contains, are as follows: Families—*Compositae* (daisy family), 258; *Filices* (ferns), 148; *Cyperaceae* (sedge family), 133; *Gramineae* (grass family), 131; *Umbelliferae* (carrot family), 89; *Orchidaceae* (orchids), 71; *Ranunculaceae* (buttercup family), 61; *Rubiaceae* (coprosma family), 55; *Onagraceae* (willowherb family), 45; *Epacridaceae* (Australian-heath family), 44; *Leguminosae* (pea family), 38; *Boraginaceae* (forget-me-not family), 33. Genera—*Hebe* (koromikos), 66 at a low estimate; *Carex* (sedges), 59; *Celmisia* (mountain-daisies), 56 at least; *Coprosma* (karamus), 48; *Ranunculus* (buttercups), 47 at least; *Epilobium* (willowherbs), 41; *Olearia* (daisy-trees), 35; *Senecio* (groundsels, mostly ligneous), 35; *Poa* (poa grasses), 33; *Myosotis* (forget-me-nots), 32; and there are 10 other genera with 20 or 30 species, and 11 with from 13 to 19 species. It is not of necessity the large genera which dominate the landscapes, for some of the smallest are of particular moment in this regard—*e.g., Arundo* (toetoe grass), 2 species; *Desmoschoenus* (pingao), 1 species, which clothes unstable sandhills in the three main islands and extends to the

Chathams; *Rhopalostylis* (nikau-palm), 2 species; *Cordyline* (cabbage-trees), 4 species; *Phormium* (New Zealand flax), 2 species; *Nothofagus* (southern-beeches), 5 species; *Corynocarpus* (karaka), 1 species; and *Leptospermum* (manuka), 4 species.

Besides the species and their varieties, the flora contains, according to recent research, no less than 425 groups of hybrids (some with hundreds of distinct forms) between the species, together with many within the species themselves between their varieties; nor is this all, for there are a few well-marked hybrids between certain genera—*e.g.*, *Helichrysum* by *Ewartia* and by *Gnaphalium*, *Hebe* by *Veronica*, *Leucogenes* × *Raoulia* (edelweiss × vegetable-sheep), and *Northopanax* by *Pseudopanax*. How widespread in New Zealand is wild hybridism appears from the fact that hybrids are now known to occur in 44 families and 108 genera; and were it not that many species never come into contact there would be still more hybrids, for certain species which never meet in nature have spontaneously given rise to hybrid progenies when planted side by side in gardens. This new knowledge concerning natural hybridism is already making radical changes in the classification of New Zealand plants, and it may also have a profound bearing on plant classification in general and on theories of evolution.

The ferns, fern-allies, and seed-plants by no means make up the whole New Zealand flora, but in addition hundreds of species have been described of the less highly organized plants (the mosses, liverworts, algae, fungi, &c.), but they certainly do not nearly represent the total number of such.

Coming next to the primary biological groups of which the flora is composed, the following gives the name of each class and the number of species it contains: *Trees* (including 12 tree-ferns), 182; *shrubs*, 316; *semi-woody plants* (including 10 ferns with short trunks), 241; *herbaceous plants* (including 93 ferns, which grow on the ground), 664; *grasslike plants*, 255; *rushlike plants*, 49; *climbing plants* (mostly ligneous, and including 7 ferns), 51; *perching-plants* (both ligneous and herbaceous, and including 26 ferns), 45; *parasites* (mostly ligneous), 17; *water-plants* (all herbaceous), 28. These biological classes are made up of many life-forms—*i.e.*, the outward forms of plants, and the shape, structure, &c., of their organs—which enable them to occupy definite habitats. In no few instances a plant can modify its form as its habitat changes or if it moves to a different habitat from that to which it is accustomed. The New Zealand flora is particularly rich in such "plastic species," as they are called. Further, the flora contains quite a number of life-forms rare or wanting in many other floras. Thus there are climbing-plants with extremely long, woody, ropelike stems; shrubs with stiff, wiry, interlaced twigs forming dense masses number about 51, and belong to 16 families and 20 genera; cushion-plants number at least 65, and belong to 21 families and 34 genera, some of them of immense proportions and quite hard, as in the vegetable-sheep (species of *Raoulia* and *Haastia*); leafless shrubs, tall or dwarf, with flattened or "round" stems (mostly species of *Carmichaelia*); the cypress form, the leaves reduced to scales, as seen in various species of *Hebe* and *Helichrysum*, but a form to be expected in the podocarps; trees with leaves bunched together on long trunks, as in the liliaceous cabbage-trees (*Cordyline*) and certain species of the

Australian-heath family (*Dracophyllum*); the tussock form, with some 40 species, belonging to 5 families and 19 genera.

Not the least interesting feature in this matter of life-forms is the presence in the flora of 200 or more seed-plants which for a longer or shorter period have a juvenile form quite distinct from that of the adult; while in about 165 species the plant remains for many years—it may exceed fifty—a juvenile, and in these cases such may blossom and produce seed, the tree juvenile below and adult above—two species, as it were, on the one plant. In some instances so different are juvenile and adult that accomplished botanists have described them as different species. How widespread is the phenomenon stands out clearly from the fact that these 165 species belong to 30 families and 50 genera, and that 51 are trees, 82 shrubs, 19 woody climbing-plants, 10 herbaceous plants, and 3 water-plants; a few ferns exhibit the same peculiarity. Some of the commonest trees come into the above category *e.g.*, the kahikatea (*Podocarpus dacrydioides*), the matai (*P. spicatus*), the kaikomako (*Pennantia corymbosa*), the pokaka (*Elaeocarpus Hookerianus*), the lancewood (*Pseudopanax crassifolium*), and others.

Taking the flora as a whole, a large proportion of the species are evergreen; conspicuous flowers are far from common; annuals and plants which die yearly to the ground are rare; water-plants are few in number; turf-making grasses are not abundant; and bulbous plants are almost negligible.

Altitude, on the one hand, and proximity to the coast, on the other, have a profound bearing on the distribution of the species. Thus about 140 species are confined to the coast-line or its immediate vicinity, and 9 families and 35 genera containing 41 species are virtually coastal. Then there are about 560 species which are confined to the lowlands and lower hills, and there are no less than 24 families and 103 genera which are purely lowland. Finally, there is a plentiful high-mountain flora, with about 510 species belonging to 38 families and 87 genera, which never descend to the lowlands, but as compared with the lowland flora the number of genera (only 16) confined to the high-mountain belt is trifling.

Latitude has also a strong bearing on plant-distribution, and, apart from a gradual change, there are three critical parallels of latitude—36° S., 38° S., and 42° S.—near which (it may be somewhat to the north or south of the line) many species attain their southern limit. On the other hand, Cook Strait and Foveaux Strait are of but little moment as barriers to advance or retreat. Far greater is the influence of wet and dry local climates, which is most striking when two such areas impinge on one another as in the case of the wet area which extends from the Tasman Sea to near the eastern base of the Main Divide, which is forest-clad to the timber-line, and the dry area extending thence to the east coast, which is clothed with tussock-grassland. In the dry area of Marlborough and the contiguous wet western area of north-western Nelson there are 36 species confined to the dry area (locally endemic) and 39 to the wet area. So, too, dry Central Otago possesses 15 locally endemic species. Speaking of the distribution of the species in a wide sense there is every transition, from those which extend continuously from the north of the North Island to Stewart

Island to those found in only one limited area (*e.g.*, *Cassinia amoena*, near the North Cape; *Xeronema Callistemon*, on the Poor Knights; *Dracophyllum Townsoni*, on the Paparoa Range), or those occurring only in two or three distant localities (*e.g.*, *Metrosideros Parkinsonii*, in north-western Nelson and Great Barrier Island; *Pittosporum patulum*, near Lake Hawea and in north-western Nelson; *Adiantum formosum*, near Dargaville and in the Manawatu Gorge and it immediate neighbourhood.

The Vegetation.

The physical features of New Zealand; its many types of climate, especially with regard to the annual rainfall and the number of rainy days; its varied altitude, ranging from sea-level to the snowfields of the Southern Alps; its many kinds of soils, particularly their water-holding capacity; the diverse frost-tolerating ability of the species; their aggressive powers—largely a matter of their life-forms and inherent plasticity—all these and other factors have led to a most varied vegetation made up of a host of plant communities, some of which appear out of place in the Temperate Zone. Thus between tide-marks in the northern rivers and estuaries there is a true mangrove community—an unexpected occurrence outside of the tropics; and even so far south as north-western Nelson groves of tall palm-trees are a striking feature. But, more than all else of an unexpected character—though familiar enough to all New-Zealanders—is the lowland forest, which resembles in no whit the forests of temperate Europe, Asia, or America, but is a true tropical rain-forest. This tropical character is shown in its groups of tall tree-ferns, which may exceed 40 ft. in height; in its wealth of ferns of all kinds; in the abundance of woody, ropelike climbing-plants and huge perching-plants far up in the forest canopy; in the several tiers of undergrowth, consisting of low trees and tall shrubs with smaller shrubs and ferns beneath, and the ground clothed with a deep carpet of filmy ferns, liverworts, and mosses, while the tree-trunks are similarly clad; in short, the forest exhibits prodigal luxuriance of growth, and Nature, as it were, runs riot. Rarely does one tall canopy tree dominate, but the uppermost story of the forest is constructed out of the crowns of various kinds of trees growing side by side, just as the undergrowth is composed of many species. But no forest is homogeneous in its structure, for differences in the topography of the area, in the water content of the soil, and in the relative amount of light in the interior of the forest, lead to various combinations of species. All the same, especially so far as the tall trees are concerned, there is an advance towards stability and uniformity, so that all the forests if not interfered with are progressing towards a "climax association," as it is named, with (as a rule) the tawa (*Beilschmiedia tawa*) dominant to the north of latitude 42°, and the kamahi (*Weinmannia racemosa*) dominant southwards.

Taking the New Zealand forests of all kinds for the whole of the region, their species number 498 (ferns and their allies 121, conifers 19, monocotyledons 70, dicotyledons 288), and they belong to 70 families and 167 genera, the largest of which are: Families—Ferns, 114; *Rubiaceae*, 34; *Compositae*, 32 (but most are confined to subalpine scrub-forest); *Cyperaceae*, 25; *Orchidaceae*, 23; *Pittosporaceae*, 21;

Myrtacaea, 18; *Araliaceae*, 14. Genera—*Coprosma*, 32; *Pittosporum*, 21; *Hymenophyllum*, 19; *Blechnum*, *Unicinia*, and *Olearia*, each 12; *Metrosideros*, 11. As for the biological groups of forest, they are as follows: Trees, 151 (but a good many are frequently shrubs also); shrubs, 84; herbaceous and semi-woody plants, 56; grasslike and rushlike plants, 29; climbing-plants, 33; perching-plants, 17; parasites, 14; and ferns, 114.

The considerable number of species for the whole New Zealand community may easily lead to an exaggerated estimate of the number of species to be found in any ordinary piece of forest, even though of considerable extent. Thus extensive pieces of lowland forest to the north of latitude 42° may possess from 150 to 180 species, and to the south of this parallel from 140 to 160 species, while 125 species is a fairly high estimate for Stewart Island.

Another class of forest, though usually possessing many rain-forest characteristics, is that where one or more species of southern-beech (*Nothofagus*—there are 5 species and very many hybrids) dominate. Such forests extend—but not continuously—from somewhat south of latitude 37° almost to the shore of Foveaux Strait. Generally they are restricted to the mountains, but in places they descend to sea-level in southern Wellington, northern Marlborough and Nelson, and to the west of the coastal mountains of western Nelson and of the Southern Alps. Throughout the high mountains the southern-beech forests generally form the uppermost forest belt, but those of northern and central Westland are a notable exception.

Nothofagus forest differs from lowland rain-forest in possessing about one-half the number of species and in lacking the exuberant richness of the forest interior, due largely to its comparative poverty in small trees, diversity of shrubs, climbing-plants, perching-plants, and ferns, as also to the forest-floor and tree-trunks being but scantily covered, or draped, with filmy ferns, mosses, and the like. A fundamental difference, and one of great economic importance, is that southern-beech forest regenerates into forest of the same class, while rain-forest proper slowly changes into forest dominated by trees of small commercial value, such replacing the valuable timber-trees (kauri, podocarps) when these die; also, all the southern-beeches, as compared with other tall New Zealand trees, are of far more rapid growth.

Where water lies here and there in shallow pools and the soil is always saturated with moisture there is semi-swamp forest which is of a true rain-forest character, though not directly dependent on a heavy rainfall, its composition depending upon the ability of many rain-forest species to tolerate a constantly wet substratum. Its most marked characteristic is the overwhelming dominance of one tall tree, the kahikatea (*Podocarpus dacrydiodes*), the tall mastlike trunks of which, standing closely side by side, and their absurdly small crowns, stamp the community as absolutely distinct in appearance from any other type of forest; while in the North Island its physiognomy is made still more remarkable by the astonishing number of asteliads perched on its branches, and resembling gigantic birds' nests. To the north of latitude 42° the pukatea (*Laurelia novae-zelandiae*) is a common lofty tree. The florula for semi-swamp forest, as a whole, consists of about 138 species, but of these only 4 species are confined almost exclusively

to the community. The forest under consideration bids fair in a few years to become almost a thing of the past, since the dominant tree is being rapidly converted into timber for butter-boxes, and the ground occupied by the forest is usually of a high class for dairy-farms.

Proximity to the sea leads to a class of forest distinct from the usual lowland type in its composition, in the much lower stature of its members, and in the extreme density of its roof, the last two characters induced by the frequent more or less salt-laden winds. The maritime climate favours the presence of trees which will not tolerate frost, so that a number of well-known trees and shrubs are confined, or nearly so, to coastal forest—*e.g.*, the kawakawa (*Macropiper excelsum*), the large-leaved milk-tree (*Paratrophic opaca*), the karo (*Pittosporum crassifolium*), the haekaro (*P. umbellatum*), the karaka (*Corynocarpus laevigata*), the akeake (*Dodonaea viscosa*), the pohutukawa (*Metrosideros tomentosa* —but the name has recently been altered to *excelsa*, which by the "Rules of Botanical Nomenclature" is correct for the time being, notwithstanding that *tomentosa* has been the sole name for nearly a hundred years!), and the ngaio (*Myoporum laetum*). Several of the above do not extend beyond latitude 38°, and the ngaio alone reaches Southland, so that coastal forest in the southern part of the South Island is made up of those ordinary lowland trees, &c., which can tolerate coastal conditions.

In addition to forest, the other great New Zealand plant-community dependent on climate is tussock-grassland. This community is of but little moment in the North Island except on the volcanic plateau and the highest mountains, but in the South Island it was the original plant-covering of most of the country to the east of the Divide of the Southern Alps, excepting northern Marlborough, northern Nelson, and parts of Southland. It extends from sea-level to the upper subalpine belt of the mountains, but is less continuous at high than at low levels. It also occupies some of the lowland and montane river-valleys of north-western Nelson and Westland, and ascends to the subalpine western slopes of the mountains.

There are two distinct types of tussock-grassland—"low" and "tall"—the former distinguished by the dominance of the medium-sized tussocks of *Poa caespitosa* and *Festuca novae-zelandiae* (one or both), and the latter by the dominance of one or both of the much taller and more massive tussocks of red-tussock (*Danthonia Raoulii* var. *rubra*), or snow-grass (*D. Raoulii* var. *flavescens*), and the numerous hybrids between them. Taking lowland and montane low tussock-grassland together, and excluding tall tussock-grassland, since they occupy a far more extensive area, and leaving out of the estimate the 74 or so exotic species now firmly established, the number of species they contain for the whole area is 216 (ferns and fern-allies 10, monocotyledons 66, dicotyledons 140), which belong to 38 families and 104 genera, the largest being: Families—*Gramineae*, 36; *Compositae*, 35; and *Cyperaceae*, *Leguminosae*, and *Onagraceae*, each 11. Genera—*Poa* and *Epilobium*, each 11; *Carmichaelia*, 9; and *Carex*, *Acaena*, and *Raoulia*, each 7. As for the biological groups, they and the number of species to each are as follows: Trees, 2; shrubs, 31; tussocks, 13; other plants of the grass form, 43; herbaceous plants, 90; semi-woody plants, 30; and ferns, 7. About 85 of the species are drought-tolerating.

Where water can accumulate and remain fairly permanent, yet not too deep to hinder land-plants rooting in the mud, there is swamp. Except forest, no class of vegetation has been so greatly altered by man, or even destroyed, so that really primitive swamps are almost unknown. The florula consists of about 74 species, which belong to 18 families and 37 genera. The following are specially common species: Raupo (*Typha angustifolia*), frequently dominant; New Zealand flax (*Phormium tenax*), dominant in drained swamp; niggerheads (*Carex secta, C. virgata*); toetoe grass (*Arundo conspicua*); cabbage-tree (*Cordyline australis*); common koromiko (*Hebe salicifolia*); karamu (*Coprosma robusta*); common coprosma (*C. propinqua*); and many hybrids between the last two. When, as frequently happens, the swamp gradually dries up, the number of shrubs increases and an early stage of semi-swamp forest is produced.

At the present time, especially in the North Island and the north of the South Island, wide areas are occupied by bracken-fern (*Pteridium esculentum*) or by manuka (*Leptospermum scoparium*), for the most part caused by fire; yet as fire was a natural agency in primitive New Zealand in the vicinity of active volcanoes, there would be natural communities of the above character. Both communities if left alone would in time change into forest. Manuka shrubland is a common feature of the Auckland gumlands, where also, in hollows, bogs are abundant, which, as for lowland New Zealand in general, are distinguished by pale hummocks of bog-moss (*Sphagnum*), a small *umbrella-fern* (*Gleichenia circinata*), and a wiry rushlike plant, the wire-rush (*Hypolaena lateriflora*). On these bogs grow several kinds of sundew (*Drosera*) and bladderwort (*Utricularia*).

The vegetation of the high mountains is both of great scientific interest and full of rare beauty. It is composed of no less than 966 species, and it is certain that a good many more species will be discovered. How strongly of New Zealand origin is the flora is revealed by the fact that of the 514 purely high-mountain species all except 16 are endemic, and probably 5 of these are endemic also. The headquarters of the true high-mountain species is in the South Island, their total being 473, as compared with 105 for the North Island, a matter which should cause no surprise since the area for plants above the forest-line is far and away less than in the South Island, where also the average height of the mountains is much greater.

Though the high mountains contain only 16 genera which do not descend to the lowlands, 8 of them are endemic. But there are 40 genera which, possessing but few truly lowland species, are well represented by purely high-mountain species, *e.g.* (to cite some of particular importance): *Danthonia, Colobanthus, Ranunculus, Nasturtium, Geum, Acaena, Pimelea, Drapetes, Schizeilema, Aciphylla, Anisotome, Dracophyllum, Gentiana, Myosotis, Hebe, Veronica, Ourisia, Euphrasia, Plantago, Lobelia, Forstera, Olearia, Celmisia, Raoulia, Helichrysum, Abrotanella,* and *Senecio.*

With but few exceptions the most beautiful flowers of New Zealand belong to the high-mountain flora, so that in due season many plant-communities are natural flower-gardens of extreme loveliness. There are the giant buttercups, white and yellow—but nearly all the flowers are of these colours—which may be seen by the acre; the lovely

ourisias, with the flowers in whorls round the stem, tier above tier, as in some of the Asiatic primulas, or the glistening green leaves, as in *O. caespitosa*, may form mats on stony ground bearing multitudes of delicate blossoms; the eyebrights—true alpine gems—their flowers white with a yellow eye or purple throat, or yellow altogether; forget-me-nots, yellow, bronze, purplish, or white; the snow-groundsel, its large marguerite-like flowers produced in such profusion that the mountain-meadow glistens like a snowfield; the two kinds of edelweiss, far surpassing their Swiss elder sister in beauty, the flowers of the "everlasting" kind, their outer leaves flannelly and snow-white. But above all other plants of the mountains, not only for their beauty of flower, leaf, and form, but for their abundance in all situations, come the various species of *Celmisia*. "Go where you will"—to quote from "The Vegetation of New Zealand" (ed. 2, p. 238)—"on subalpine and alpine herb-field and their silvery foliage strikes the eye, it may be in stately rosettes of dagger-like leaves, in circular mats trailing over the ground, or in dense cushions. Their aromatic fragrance fills the air; from early till late summer some of their white heads of blossom may be seen, while in due season gregarious species clothe both wet herb-field and dry, stony slopes with sheets of white."

The life-forms of the high-mountain plants are in great variety and frequently of striking appearance. Cushion-plants, rosette-plants, mat-forming plants, and stiff-stemmed shrubs are greatly in evidence. Hairiness, leathery texture, and surprising rigidity, perhaps accompanied by needle-like points, as in the giant spaniards (*Aciphylla Colensoi*, *A. maxima*, &c.), are common characteristics of leaves.

There are many plant-communities composed of combinations of tussock-grasses, herbaceous plants, semi-woody plants, dwarf or creeping shrubs, and cushion-plants which are sometimes dense enough, and sometimes so open that there is more stony ground than vegetation. The most surprising community is that of unstable stony debris—the "shingle-slips" of the shepherds—which covers the slopes of certain dry mountains for some thousands of feet, particularly in Marlborough and Canterbury. No less than 33 species occupy this inhospitable station, 25 of which are confined thereto. So far apart do the species grow—frequently many yards—that they bear no relation to each other. Their life-forms are clearly in harmony with the peculiar environment. All have thick fleshy or leathery leaves, frequently of the grey colour of the stones. In 16 species the part above the ground is annual; the shoots nearly always lie close to the stones, but if buried they have the faculty of growing upwards again. One species, *Cotula atrata*, has a jet-black flower-head, with stamens like tiny golden pin-heads.

Shrubland is common in the mountains, the most characteristic being the subalpine scrub, which on many mountains forms a dense belt above the timber-line. That typical of a wet climate consists of rigid or wiry-stemmed shrubs which grow into one another, and the main branches of many are parallel to the slope and project downwards. The scrub may be so dense that one must either crawl beneath it or walk on its treacherous roof. For the whole of the region the community consists of about 122 species, belong to 28 families and 49 genera. The chief groups of plants which compose the scrub are shrubby com-

posites and epacrids, wiry shrubs with densely entangled twigs (mainly species of *Coprosma*), species of *Hebe, Phormium Colensoi,* various podocarps, and giant spaniards. On river-terraces scrubs with species of *Hebe* dominant are frequent, and fringing stony river-beds there is often an open scrub of wild-irishman (*Discaria toumatou*)—one of the few spinous plants in the flora.

Rock-vegetation is always of interest, and this is particularly so in the high mountains. The number of species occurring on rocks is about 190 (families, 36; genera, 74). About 44 species are virtually confined to rocks, and such include a dwarf fern (*Polypodium pumilum*), certain rosette plants at present referred to the genus *Nasturtium*, one or two dwarf spaniards and a few forget-me-nots, hebes, celmisias, and raoulias.

Outlying Groups of Islands.

The floras of the following groups of islands, far distant from the mainland, are distinctly part of that of New Zealand. The Kermadecs contain 117 species of ferns, fern-allies, and seed-plants, 16 of which are endemic, while 89 belong also to New Zealand proper. The largest island (Sunday Island) is covered with forest in which a variety of *Metrosideros collina*, a near relative of the pohutukawa, is the principal tree. The Chatham Islands possess at least 257 species, of which 36 are endemic, though several of the latter are trivial varieties merely, while the remainder of the flora is, with one exception, found on the mainland. Forest, moor, and heath are the principal plant communities. The leading tree is the karaka, but by the Moriori called kopi. On the moors are great thickets of a lovely purple-flowered shrub, *Olearia semidentata*. There are two remarkable endemic genera, *Coxella* and *Myosotidium*, the former belonging to the carrot family, and the latter a huge foget-me-not, now nearly extinct. The subantarctic islands (Snares, Auckland, Campbell, Antipodes, Macquarie) have a dense vegetation made up of 193 species, no fewer than 60 of which are endemic, the remainder being found in New Zealand, but chiefly in the mountains. Forest is found only on the Snares and the Aucklands, with a species of *Olearia* and the southern-rata as the dominant trees respectively. Extremely dense scrubs occur on the Auckland and Campbell Islands, and moor, sometimes with huge tussocks, is a characteristic feature of all the islands, thanks to the enormous peat deposits and the frequent rain. Several herbaceous plants of stately form (species of *Pleurophyllum, Anistome, Stilbocarpa,* and *Celmisia*) and with flowers of extreme beauty—some of them purple in colour—occur in great profusion.

The Cook Islands, though a part of the Dominion, possess a Polynesian flora quite distinct from that of New Zealand, and are excluded from this notice, while, on the contrary, the flora of the Macquarie Islands (belonging to Tasmania) is a portion of that of New Zealand.

Besides the indigenous, an important introduced element, consisting of about 630 species, mostly European, has followed in the wake of settlement. These aliens are in more or less active competition with the true natives. There is a widespread but quite erroneous

opinion that the latter are being eradicated in the struggle. This is not the case. Where the vegetation has never been disturbed by man there are *no* foreign plants; but where man, with his farming operations, stock, and burning, has brought about European conditions, then certainly the indigenous plants have frequently given way before artificial meadows and arable land, with their economic plants and accompanying weeds. But in many places associations not present in primitive New Zealand have appeared, owing to man's influence, composed principally, or altogether, of indigenous species. On the tussock-grassland invader and aboriginal have met, and though the original vegetation is changed there is no reason to consider the one class or the other as the conqueror. Finally, in course of time, a state of stability will be reached, and a new flora, composed partly of exotic plants and partly of those indigenous to the soil, will occupy the land, and, save in the national parks and scenic reserves, but only if these are kept strictly in their natural condition as to both plants and animals, this new flora will build up a vegetation different from that of primeval New Zealand.

NOTE.—The foregoing article is republished, with slight alterations, from the New Zealand Official Year-book, 1930.

TREES FOR SHELTER AND OTHER FARM PURPOSES.

THE following trees are recommended for planting in New Zealand, for shelter and other farm purposes, by the State Forest Service in its Circular No. 29 as under:—

CONIFERS.

Insignis Pine (Pinus radiata).—Of all pines grown in New Zealand this well-known tree has proved itself the most rapid growing, producing a heavy crop of timber in thirty years from planting. There should be a plantation of this valuable tree on every farm. Owing to its rapid growth and the dense shade thrown, it is recommended for planting to smother blackberry, gorse, and other noxious weeds. For this purpose the trees should be spaced 6 ft. apart in the rows and the same distance between rows, when 1,210 trees will be required to plant an acre. If planted in a single or double row, as a wind-break, the trees should be spaced 12 ft. or 16 ft. apart in the rows and 8 ft. between rows. Spaced at this distance the trees will retain their lower branches and form better shelter. For the production of timber the trees should be spaced 8 ft. apart and the same distance between rows, 680 trees being required to plant an acre.

Macrocarpa (Cupressus macrocarpa).—This tree should be planted in soil conditions that will allow the development of a deep root-system. On poor or very dry land the macrocarpa is short-lived, and tends to become "stag-headed," but wherever its roots can sink deeply a fine tree is assured. Some of the finest specimens have been grown in

pure sand along the coast. It is a splendid shelter-tree and withstands salt winds, while the timber produced is moderately strong, very durable in contact with the ground, and provides excellent firewood. For shelter purposes best results are obtained from 12 ft. to 16 ft. spacing, while trees grown 6 ft. apart with the same distance between rows produce good straight trunks, from which timber, easily split into fencing-material, will be obtained. The use of trayed or boxed macrocarpa trees is strongly recommended in preference to open-rooted stock, which is difficult to successfully transplant. These plants can be lifted with a ball of earth from the trays, which greatly enhances the chance of a successful strike.

California Redwood (Sequoia sempervirens).—As its name implies, this species is a native of California, where in the mature forest it produces a very heavy stand of very durable timber of high use value. Redwood has made rapid growth in the North Island, and, although it cannot under these conditions be expected to produce timber of the same excellent qualities as when grown in its natural habitat, locally-grown redwood will certainly be of great value for numerous purposes where strength is not of paramount importance.

Lawson's Cypress, or Port Orford Cedar (Cupressus Lawsoniana).—This handsome tree, from the Pacific States of North America, is recognized as one of the finest shelter-trees yet introduced into the Dominion, where, in light soils, it has done remarkably well. In the Waikato in particular Lawson's cypress has proved to be an ideal shelter-tree for the dairy farm. Although comparatively slow growing, it responds quickly to cultivation, while by the use of a little manure the growth may be increased. If the land on which the young trees are to be planted is ploughed, and a row of potatoes grown on each side of them, at least twice the growth, compared with those neglected in the grass, may be expected. Two-year-old transplants are recommended when planting this species, which produces a very durable timber, well and favourably known in the United States as Port Orford cedar.

Prickly-cone Pine (Pinus muricata).—This species is not quite so fast-growing as the insignis pine, but produces better shelter, and is recommended for planting in coastal districts subject to salt gales. It should be spaced as recommended for insignis pine, and two-year-old stock used for planting.

Bentham's Cypress (Cupressus lusitanica var. *Benthami).* A Mexican tree, similar in form to macrocarpa, but with a sage-green foliage and more graceful habit. It provides splendid shelter, and is recommended for planting on clay soils where Lawson's cypress does not thrive so well. Two-year-old trees are recommended for planting.

Japanese Cedar (Cryptomeria japonica). This native tree of Japan has proved hardy and has thrived in many parts of New Zealand, producing a fairly strong durable timber suitable for many purposes. It is an ornamental tree and should be spaced as recommended for insignis pine, and best results will be obtained from two-year-old transplants.

Douglas Fir, or Oregon Pine (Pseudo-tsuga Douglasii). The natural habitat of this species extends from California to British Columbia.

On the high, free soils of the centre of the North Island Douglas fir has proved to be moderately fast growing, but is unsuitable for the clay lands in the Auckland Province. In the South Island it is suitable only for use on foothills or moist districts. Does not succeed in hot, dry areas. This species transplants well, and should be planted as two-year-old stock.

Western Red Cedar (Thuya plicata).—In the State of Washington and in British Columbia this species grows to a huge size and produces vast quantities of light, coarse-grained durable timber. It has been only moderately successful in the North Island and when planted on dry soils tends to die when about twenty years old, but thrives better in moist situations. Two-year-old transplants should be used when planting.

Maritime Pine (Pinus pinaster).—This pine is a native of Europe, where it has been widely used in sand-dune reclamation. In certain parts of France, where it has been extensively planted for the same purpose, considerable revenue is derived from the resin and turpentine as well as from the timber. This species has not been as successful as the insignis pine and the prickly-cone pine, which afford better shelter, withstand the salt winds equally as well, and yield up to four times the timber produced by the maritime pine in the same period.

Lodgepole Pine (Pinus Murrayana).—A very hard tree, which should prove of great value for shelter purposes in high country. On account of the many stems springing low down on the trunk, this pine forms a windbreak of great density. The timber is usually small but of good quality.

Corsican Pine (Pinus Laricio).—As its name implies, this pine is a native of the Island of Corsica. It has been extensively planted in Europe, and has done better in New Zealand than has any other European conifer. In the colder regions of the South Island, where insignis pine will not endure the cold, this tree may be substituted. Since it requires about fifty years to produce merchantable timber, it is not recommended for extensive planting by farmers and others requiring timber or tree shelter in the shortest possible time.

Pondosa Pine, or Western Yellow-pine (Pinus ponderosa).—A native of the Pacific States, where it produces large quantities of good timber which is used for many purposes. The wood is stronger and harder than that of many other exotic pines grown in New Zealand, but, like the Corsican pine, requires at least fifty years to mature.

EUCALYPTS.

In order to ascertain the most suitable species for cultivation of these valuable Australian hardwoods, the State Forest Service has been carrying out experiments for the last twenty-five years, and over one hundred species have been tested at Rotorua. Of this number it has been found that the species most suited to North Island conditions are those classified hereunder:—

E. Macarthuri.	*E. saligna.*	*E. fastigata.*
E. viminalis.	*E. eugenioides.*	*E. obliqua.*
E. Gunnii.	*E. Muelleriana.*	*E. regnans.*
E. botryoides.	*E. pilularis.*	*E. delegatensis (gigantea).*

E. pilularis is one of the most valuable eucalypts yet successfully grown in the Dominion, but is suitable only for the warmer districts of Auckland, Hawke's Bay, and Taranaki.

One cord of well-dried eucalypt wood (*E. viminalis*) is equal in heating-value to about one ton of coal.

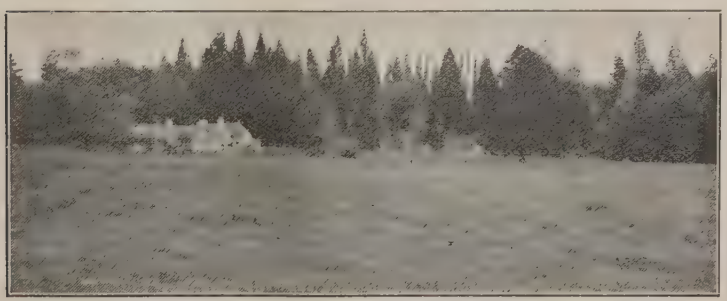
When temporary posts are required quickly it is best to space the trees 6 ft. apart in the rows and the same distance between rows. Planted at this distance 1,210 trees are required to plant an acre. After about ten years material which will last for several years may be obtained from the plantation, and the thinning-out process should be continued until the trees are spaced about 12 ft. apart, or 300 to the acre. These latter will produce the main crop, which will take about thirty years to mature. Eucalypts are probably the best trees for farmers to plant to produce a quick crop for fencing-material and fuel.

POPLARS.

Open-headed poplars as shade-trees for stock will be found useful, especially in wet places. As some are easily grown from cuttings, every farm should have an abundance of these trees as shade for stock during the summer months. Poplars may play an important part in the solution of the butter-box problem. The following species are recommended for planting: *Populus serotina*, *Populus fastigiata* (Lombardy poplar), *Populus eugenei* (a good timber-tree), *Populus nigra* (the black-poplar), *Populus regenerata* (a fast-growing variety), *Populus robusta* (a very vigorous tree).

BLACK-WATTLE (*Acacia decurrens* var. *mollis*).

In suitably mild districts this species of acacia will provide quick temporary shelter, fuel, and second-rate fencing-material; but, as it is susceptible to attack by the acacia gall-fungus, it is not recommended by the State Forest Service for extensive planting. Direct sowing of the seed on the site selected will give satisfactory results. Seed should be scalded or soaked before planting.



A WELL-PLANTED HOMESTEAD.

IMPORTATION OF FERTILIZERS IN 1929–30.

F. T. LEIGHTON, Analyst, Chemistry Section, Department of Agriculture.

THE accompanying tables of statistics of artificial fertilizers imported into New Zealand during the year ended 31st March, 1930, have been compiled from data supplied by courtesy of the Comptroller of Customs.

The increasing appreciation of the value of phosphatic fertilizers is indicated in the returns, 346,000 tons of this class having been imported during the year under review. Since nearly half of this amount represents mineral phosphate imported for use in the manufacture of superphosphate, it may be taken that the consumption of phosphatic fertilizers in New Zealand has now reached a figure well in excess of half a million tons per annum, comprising some 300,000 tons of superphosphate, 100,000 tons of basic slag, 100,000 tons of ground mineral phosphate and phosphatic guano, and not less than 20,000 tons of phosphatic animal-manure (mainly produced in the Dominion).

A marked feature of this year's importations is the increase in the amounts of North African phosphates. The bulk of the Moroccan phosphate brought into the Dominion has doubtless been utilized in the manufacture of superphosphate, but a certain amount is very finely ground locally and is sold in the raw state. The 37,000 tons recorded as North African phosphate (other) is practically all Tunisian (Gafsa) phosphate, ground in Belgium, whence it is imported into the Dominion.

The importations of basic slag are only some 1,100 tons in excess of those for 1928–29, in which year, however, the quantity of slag imported was nearly double that of any previous year. Some small shipments of 15 per cent. slag have been placed on the local market, but it would appear that the New Zealand farmer is now accustomed to require a high-grade (17–20 per cent. or 20–22 per cent. phosphoric acid) basic slag of high citric-acid solubility, and that there is little demand for the lower grades. These, though they may in many cases be equally efficacious in proportion to their phosphoric-acid content, suffer from the disadvantage of higher relative cost of transport (and thus greater cost to the farmer) per unit of phosphoric acid.

Importations of French (Alsatian) potassic fertilizers have dropped nearly 50 per cent. from the previous year's figures, while the quantity of German fertilizers of this type has also declined somewhat. To the farmer accustomed to the finely crystalline Stassfurt products, the coarser, unevenly coloured Alsatian potash salts are not always attractive, and a number of samples have been sent to the Department's Chemical Laboratory for analysis, by purchasers who suspected their purity. It may be said that, chemically, the Alsatian potash salts are in no way inferior to those more familiar products of Stassfurt.

Coming to nitrogenous fertilizers, it will be seen that a notable increase in the quantity of sulphate of ammonia imported has followed the interest aroused by the development in New Zealand of intensive methods of grassland management and the use of ammonium sulphate

in this connection. Importations of nitrate of soda also increased slightly, while small shipments of calcium cyanamide (nitrolim, lime-nitrogen) from Norway also arrived.

Under "Fertilizers unspecified" are included a total amount of 760 tons from Germany (see reference to German concentrated fertilizers in last year's notes—*Journal* for June, 1929, p. 404), and 500 tons (probably cyanamide) from Norway.

TABLE 1.—SUMMARY OF FERTILIZER IMPORTATIONS, 1929–30 AND 1928–29.

Fertilizer.	Quantity.		Declared Value	
	Year 1929–30.	Year 1928–29.	Year 1929–30.	Year 1928–29
	Tons.	Tons.	£	£
Bonedust and bone-char ..	1,420	554	11,854	4,751
Basic slag	94,332	93,222	273,190	235,285
Superphosphate	525	1,037	1,309	2,587
Nauru/Ocean Islands phosphate ..	136,410	134,323	169,077	175,487
Island phosphate (other)* ..	34,587	43,734	46,390	66,816
Egyptian phosphate	300	6,000	1,024	18,975
Moroccan phosphate	35,348	22,173	49,090	32,667
North African phosphate (other) ..	37,424	12,499	94,020	29,856
Phosphate (not otherwise specified)	5,505	..	13,526	..
Kainit	839	880	2,270	2,860
Muriate of potash	28	36	188	397
Sulphate of potash	1,106	1,727	11,273	17,854
Potash salts (other)	6,217	10,786	31,178	50,288
Sulphate of ammonia	11,015	2,268	119,202	28,053
Nitrate of soda	2,263	1,780	22,442	18,968
Cyanamide	97	4	828	30
Sulphate of iron	63	72	469	510
Fertilizers unspecified	1,283	802	17,037	5,687
	368,762	331,897	864,367	691,071

* For details see Table 3 (next page).

NOTE.—The values shown in the above table are those declared for Customs purposes, and represent the current domestic values in the countries of exportation, plus 10 per cent.

TABLE 2.—IMPORTS OF THE PRINCIPAL PHOSPHATIC FERTILIZERS, 1920–30.

Year ended 31st March,	Bonedust.	Basic Slag.	Super-phosphate.	Pacific and Indian Oceans Phosphate.	Egyptian Phosphate.	Moroccan Phosphate.	North African Phosphate (other).
	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
1920 ..	6,272	2,759	15,842	38,861	15,000	..	..
1921 ..	4,440	10,823	40,731	70,208	10,810	..	..
1922 ..	4,063	13,488	3,140	45,956	..	..	..
1923 ..	2,446	19,641	..	69,591	..	..	..
1924 ..	4,158	39,632	255	76,517	5,996	..	..
1925 ..	2,452	45,682	10	108,163	8,530	..	..
1926 ..	2,085	44,314	500	97,488	10,037	..	..
1927 ..	1,805	53,327	15	161,541	5,979	..	..
1928 ..	725	48,913	6,616	143,373	6,603	13,389	..
1929 ..	554	93,222	1,037	178,057	6,000	22,173	12,499
1930 ..	1,420	94,332	525	170,997	300	35,348	37,424

TABLE 3.—IMPORTATION (IN TONS) OF PRINCIPAL ARTIFICIAL FERTILIZERS FOR YEAR 1929–30, SHOWING COUNTRIES OF ORIGIN AND NEW ZEALAND PORTS OF ENTRY.

New Zealand Port of Entry.	Australia.		Chile.	India.	Pacific and Indian Oceans Islands.		United Kingdom.			Belgium.			France.			Germany.		United States of America.	Egypt.	Morocco.	Netherlands.
	Bonedust and Bone-char.		Nitrate of Soda.	Bonedust.	Island.	Phosphate.	Phosphate.	Sulphate of Ammonia.	Basic Slag.	Phosphate.	Basic Slag.	Potash.	Phosphate.	Basic Slag.	Potash.	Basic Slag.	Potash.	Sulphate of Ammonia.	Phosphate.	Phosphate.	Superphosphate.
Auckland ..	320		2,262	925	Nauru/Ocean	63,460	830	6,168	6,500	27,708	36,273	40	110	..	1,011	7,406	2,052	170	..	24,173	..
					Seychelles ..	4,085															
					Makatea ..	4,071															
New Plymouth	..		..	..	Nauru/Ocean	10,807	125	1,025	4,930	932	21,198	..	..	..	260	575	630	..	..	5,715	..
Wanganui ..	..		..	..	Walpole ..	1,696	..	..	..	..	..	..	..	..	..	..	..	..	..	2,666	..
					Nauru/Ocean	17,572															
Wellington ..	..		..	50	..	..	575	679	1,995	1,870	6,200	..	..	..	260	1,220	202	..	..	50	..
Nelson ..	..		..	..	..	..	..	50	20	100	1,270	..	..	..	96	..	54	..	..	..	..
Lyttelton ..	..		..	..	Nauru/Ocean	28,150	..	851	..	815	270	..	..	..	328	..	229	226	..	..	..
					Seychelles ..	1,346															
					Makatea ..	3,256															
					Walpole ..	1,763															
Timaru ..	..		..	..	Walpole ..	1,216	..	..	..	861	..	..	..	..	80	..	20	..	..	..	..
Oamaru ..	..		..	..	..	..	..	..	..	150	..	..	..	..	..	..	10	..	..	..	..
Dunedin ..	..		1	25	Seychelles ..	3,649	50	1,050	..	1,807	1,160	..	..	..	300	400	210	50	300	260	..
					Nauru/Ocean	18,510															
					Walpole ..	897															
Invercargill ..	100		..	..	Seychelles ..	10,499	3,715	755	100	3,181	4,590	30	..	75	1,025	150	813	..	..	2,454	500

SEASONAL NOTES.

THE FARM.

Pasture Management.

NORMALLY during June the grassland-farmer is busy carrying on important work which was commenced earlier in the season. If harrowing and top-dressing have not been completed, then these two tasks will call for attention. Why and how these operations should be done has been indicated in a general way in the March and April notes.

On most farms there are certain paddocks which are more suitable than the others for providing late-winter and early-spring feed. A special point should be made of harrowing and top-dressing such paddocks in good time. Usually the paddocks which are suitable in this connection are those which are well drained and covered with a pasture containing a considerable amount of rye-grass, and possibly also are provided with some shelter. Young pastures recently sown, at times being soft, are prone to be unduly broken up, with harmful effects if used much for winter and spring grazing, and they should not be used more than is necessary for preventing the growth becoming detrimentally long. With such pastures the aim should be to obtain a happy balance in respect to severity of grazing—to prevent the growth becoming so long as to bring about undesirable shading of any species, particularly the more slowly establishing ones, and at the same time to graze not more closely than will serve to avoid the harmful shading effect, and in such a way as to minimize as much as possible " poaching " of the ground.

If a farm possesses pastures showing evidence of current infestation with grass-grub, then, when possible, hay and roots should be fed out on the infested areas ; the additional stock-trampling and consolidation which results is not to the liking of the grubs, and the hay may contain viable seeds of valuable pasture species, which on germinating will tend to repair the ravages of the grubs and thus build up the pastures again.

It is not generally advisable to apply soon after each other lime in any of its forms and any of that group of phosphates which are chemically alike and which include raw rock phosphates, Island phosphates, and African phosphates. These phosphates are all relatively low in availability to crops and slow in their action, and become more markedly so when used on land which has received lime. Liming carried out in close time proximity to the application of basic slag may be expected to reduce the speed of action of the slag. When the question arises whether lime should be applied before phosphates or phosphates before lime in the same season, it may be taken as a general rule that it is preferable to do the liming first. But it is doubtful whether it matters much which material is applied first. From inquiries received it is clear that some farmers are inclined to look upon lime as a suitable substitute or alternative for phosphates. This is not the case ; lime may at times serve to make phosphates more effective and profitable, but it will not fill the function of the phosphates.

In many districts pastures (particularly those containing a good deal of rye-grass) if shut up towards the end of May or early in June will provide a substantial amount of fresh grass towards the end of July and during August. The amount of July-August feed obtainable in this way can be increased by the use of nitrogenous manures on the grassland, but whether such use of nitrogenous manures will prove profitable depends on a number of circumstances which vary from farm to farm. For

instance, if a suitable pasture containing a good deal of rye-grass is available, the use of nitrogenous manure is more likely to prove profitable on it than on an old pasture containing little rye-grass. Again, if a farmer is faced with the likelihood of a shortage of winter feed the use of nitrogenous manure is apt to be of much more value to him than were he better supplied with winter feed.

Value of planning Work ahead.

The planning of future farm operations may opportunely be considered at this time of the year, because the general lines of the work for next season should be decided upon at this stage. There are several important matters to which thought might well be given. In the first place greater permanency is being imparted to our pasture management by top-dressing, and by the making available of superior strains of the most important pasture species such as perennial rye-grass. This greater permanency introduces new features to the special forage-crop position. Primarily it will reduce the amount of land it is desirable to put under the plough annually for the double purpose of providing special forage and of rejuvenating the grassland. Indirectly in many instances this will create a more urgent need than ever for greater yields to the acre in respect of such crops as mangels, turnips, and rape. In such instances there will be no decrease in the total tonnage of such crops which is required, but it will be desirable to grow that tonnage on a smaller area.

In general on high-priced land greater expenditure is justified than is usually realized, provided it results in appropriate crop-increase. This may be exemplified by considering the mangel crop. Available evidence suggests that there are more mangel areas which yield in the vicinity of 30 tons to the acre than there are areas which yield 60 tons to the acre. An expenditure of £4 10s. an acre on manure, seed, and cultivation may be necessary to secure a yield of 30 tons to the acre. If another £6 an acre is spent and a 60-ton crop secured, this would at first sight seem to be bad business, since the extra £6 expenditure produced only 30 extra tons, whereas the initial £4 10s. expenditure resulted in a yield of 30 tons. However, if a rental charge for the land of £6 is added, it is found that the 30-ton crop is costing 7s. a ton to produce, while the 60-ton crop is costing only 5s. 6d. a ton. The important point that this illustrates is that on high-priced land expenditures far above what are generally considered profitable—provided they lead to suitable crop-increase—really lessen the cost of crop-production. This point might well be kept in mind by many when planning the cropping programme for next season. To avoid all chance of misconception, it may be as well to state that the reverse rule at times applies in respect to land of low cost, and instances can be readily conceived in which the doubling of the crop-yield to the acre would be contrary to true farm economy.

In the planning of the cropping programme for the season 1930–31, another matter that might well be given consideration is the fact that the raising of high-yielding mangel, carrot, and lucerne crops is made easier and more profitable if these crops are given the advantage not only of high fertility, but also of freedom from weeds. Often relatively high fertility may be secured by breaking up old pasture for these crops; in any case nowadays the requisite fertility can always be provided, should it be naturally absent, by the use of suitable artificial fertilizers. Hence, because of the resort which may be made to manures, the natural fertility of the land sinks in importance, and the weed population of the land becomes a dominant consideration. Again, in respect to weeds, old pasture-land often exhibits superiority, provided it is handled properly. And this is so even though, as is sometimes the case, the surface layer is well populated with weeds and weed-seeds.

This matter is mentioned at the present time because farmers frequently are advised to begin the preparatory cultivation for these crops at about this season, and to carry out two deep ploughings during that preparatory cultivation in order to obtain the desirable deep and well-pulverized seed-bed. Because of this somewhat common advice it seems well to point out that from the weed viewpoint the two deep ploughings recommended constitute just one deep ploughing too many. The first deep ploughing will put many weed-seeds at such depth in the soil that they will not germinate and hence will provide no trouble so long as they are left in that position. Why, therefore, bring them to the surface again? There is no good reason for doing this, provided a good seed-bed can be secured in some other fashion. Many find that the necessary good seed-bed can be obtained without two deep ploughings; the method they follow is to skim-plough and disk in the autumn, thus pulverizing the surface soil which contains the weeds and which later on is turned down deeply by one full ploughing and left there. This method may prove disastrous in the case of land infested with twitchy weeds, such as couch, sorrel, yarrow, and creeping-fog. But one really should not attempt to grow crops such as lucerne, carrots, and mangels on land infested with twitchy weeds.

In order to place all the weed-infested soil well underground it is at times of value to use on the plough a suitable skimmer attachment, thus lessening the weed-growth which often arises freely between the furrows. The use of a broad well-turned furrow materially helps in the complete and deep burial of surface weeds.

When the use is contemplated for forage-crop production of land which has been under the plough recently, then weeds again deserve consideration. Apart altogether from perennial twitchy weeds, the presence of considerable numbers of the seeds of spring-germinating annuals is most undesirable. Commonly occurring examples are spurrey (or yarr) and fat-hen in the South Island, and willow-weed and nightshade in the North Island. All means of minimizing weed troubles with forage crops require to be fully exploited. Many farmers have given up or are thinking of giving up forage-crop production. This is often chiefly because of labour considerations, and weeds beget labour difficulties. More forage-crop acreage would generally give increased gross production. Many farmers would do well to hesitate about dispensing with forage crops to any extent because of weeds until they have considered all promising means of combating the weed invaders. The point of particular interest is that available means of avoiding weed troubles are often not utilized simply because of lack of a little planning well ahead.

In many parts of New Zealand the supply of soil-moisture during the growth of the crop is apt to be the factor which limits the yield of heavy-yielding crops such is mangels, potatoes, and swedes. This fact constitutes a good reason why in the drier districts it is advisable to select the land for these crops in good time. Ploughing early enables rains, instead of running off the hard surface, to sink in and to be held in reserve for the use of the crop during its growth. The importance of building up a moisture reserve in this way becomes obvious when definite cases are considered. During the growth of a mangel crop yielding 50 tons to the acre at least 2,000 tons of water per acre will have escaped from the soil through the leaves. Of course during the same period water would also have escaped from the soil by surface evaporation. The water lost through the crop-leaves alone is equivalent to 20 in. of rainfall. In many districts where mangels are grown successfully 20 in. of rain does not fall during the whole of the time the crop occupies the ground. Hence, unless substantial moisture reserves were built up prior to the sowing of the crop, one would have to be content with yields much below 50 tons to the

acre. Yet in these districts efficient farmers by commencing work in good time obtain yields up to and above 50 tons to the acre.

Crop Utilization.

It is not ordinarily desirable that stock be allowed to go down much in condition before a commencement is made with the feeding of reserves of such fodders as roots, hay, and ensilage. It is all very well to count on the possibility of having to provide for a late, severe spring, but this looking to the future should not be carried too far at the expense of the current requirements of this stock.

The feeding-out of swedes on land which will be sown in turnips or swedes after a season or so should be avoided; if it is not, the land may readily be contaminated with the germs of such diseases as club-root and dry-rot, and these may attack badly the later crops which are subject to the same diseases. Fortunately, mangels and carrots are not likely to pass on crop-diseases in a similar way, and so care in this connection need not be taken in respect to them.

The winter feeding of stock on roots alone is undesirable, because stock so fed are called upon to live on a diet very unsuited to their needs. It is much too watery and cold for ordinary requirements, and is likely to set up digestive disturbances—all of which means waste. Roots may suitably be supplemented with dry fodder such as hay or chaff.

The value of ensilage as a winter feed for dairy cows has been fully established by its widespread successful use in this connection in previous seasons. The amount of good-quality ensilage that should be fed will depend to a considerable extent upon the amount of feed the stock are able to obtain in their grazing. Those who have had experience in the feeding-out of roots and hay may obtain some guidance from the fact that 1 lb. of grass ensilage equals in feeding-value approximately 2 lb. of roots, and that 2½ lb. of grass ensilage equals in feeding-value 1 lb. of good average hay. The position should not arise in which animals will be called upon to maintain themselves on ensilage alone. Rather should the ensilage be used to supplement pasture in the ration, just as hay or root are ordinarily used in that way. In overseas trials ensilage has been fed with success to dairy cows in amounts ranging up to 40 lb. daily, but under New Zealand conditions it should seldom be necessary to attempt to feed so much, for usually smaller quantities will be sufficient to supplement the feed provided by the pastures.

Ensilage has been fed with good results to sheep when used as a supplement in the ration at the rate of about 2 lb. daily. Our experience is too limited to enable us to say what is the maximum amount which can be fed daily to sheep.

On many farms the pulling and storing of mangels should now receive attention, particularly if the land occupied by the crop is required for another crop such as oats. It is not easy or safe to lay down any rules about the pulling of mangels. In certain districts the crops will continue growing in weight well beyond the date fixed by some as that at which pulling should have been carried out. It is very doubtful whether it is advisable to pull such growing crops early in June if they are not required for use until late in August or September, unless the land they occupy is especially required for some other crop or likely to become so wet later that it will be very difficult to cart the crop off it. However, if the crop is to be fed to stock earlier than has been mentioned, then it should be pulled in good time to allow it to ripen or mature before the stock consume it. Freshly pulled mangels cannot stand frost as well as those still in the ground or that have been pulled for a few days. Hence, if at all possible, in order to avoid frost injury broken mild weather should be selected for

the work of pulling. Many sheep-farmers are successfully utilizing mangels later on in the season without storing them. If broken-mouthed ewes are available they are put in to eat off the tops; then the roots are harrowed out in breaks some days prior to the sheep being given access to them.

Tillage Operations.

Where the soil is not too wet and cold oats, barley, or rye-corn may often be sown with success in June to provide useful spring feed. Such crops should not be drilled deeply, and they will respond profitably to a dressing of from 1½ cwt. to 2 cwt. of superphosphate an acre. Disease-control measures by seed treatment should be carried out as with earlier-sown cereal crops.

The team or tractor should be kept at work as much as possible preparing land for spring sowings of cereal and root crops. Often when land which was recently under the plough is too wet to work without harm, lea land which is being broken up can quite well be worked.

—R. P. Connell, M.A., Fields Division, Palmerston North.

THE ORCHARD.

After-harvest Work.

With the rush of harvesting, packing, and marketing finished, numerous off jobs in the sheds and orchards will present themselves, and the difficulty will be in deciding the order of priority. Pruning, planting, and ploughing can all be proceeded with, and a general clean-up of the shed, overhaul of plant and orchard cases, and the destruction of rejected diseased fruit will be necessary to restore the desirable orderly condition. Any inside work will doubtless be deferred for a wet day, and outside operations expedited while favourable conditions prevail.

Autumn ploughing on bare land will take precedence while the soil is comparatively dry, particularly on heavy land where working in a wet condition produces a furrow of dough-like consistency which remains tight and compacted and impervious to the ameliorating influence of frost or sunshine. On hillsides where excessive scouring is likely to occur it is advisable to plough obliquely across the face of the hill to lessen the rate of flow, but where the water is diverted into depressions provision must be made for its escape, or injury to the roots and possibly the death of the trees will result.

Planting.

Young trees may be planted as soon as the soil becomes sufficiently moist. Under favourable conditions—and good results cannot be expected if conditions are not favourable—autumn planting is preferable to spring planting, but it is essential that the soil should be dry enough to work without forming a puddle when trodden or dug over. The production of root will commence in advance of any visible action in the top, and disturbing the tree for spring planting is liable to destroy the rootlets and delay its establishment, with serious detrimental results in the event of an early cessation of damp weather.

Apart from late planting, the most common cause of failure is planting too deeply. Under this condition trees assume something of a starved appearance, starting into growth each season, but failing to produce a reasonable amount of young wood, eventually dying back gradually from the tips and providing a good illustration of the general symptoms of root trouble. The correct depth to plant can generally be gauged by examination of the stem, the junction of the smooth slightly blanched

portion with the harder dark bark indicating the previous ground-level, which should not be varied; or, with a few exceptions such as some of the nuts and occasionally in seedling pear stocks where the underground portion of the trunk is thickened, the formation of root commences about a couple of inches below the surface, and replanting to about that depth should be approximately correct.

A little extra work in preparing the holes is well worth while, and the object should be to provide conditions which will stimulate root-action in all directions, so as to ensure a good anchorage and rapid growth. Having dug the hole, the bottom soil should be replaced with nice surface soil in which two or three handfuls of blood and bone has been mixed, and mounded slightly in the centre, so that when the filling is replaced the roots will have a downward tendency. The hole should be dug to accommodate the roots with some room to spare without bending them to make them fit the hole, for the future security of the tree is dependent upon an even distribution of the roots providing a stay in each direction. Any damaged roots or dried-out ends should be removed immediately before planting, and as a protection against sun and wind and possible dry soil conditions, it is advisable to dip in a puddle of soil and water. In covering the roots only friable fine soil should be used, and when the hole is nearly filled it should be well trodden to firm the tree and exclude air-pockets, then completing the filling, leaving the top soil loose. The tree should be heavily pruned to compensate for the loss of root and to form the foundation of the framework.

Manuring.

The application of slow-acting manures should be proceeded with, in order that the chemical changes may proceed and the plant-food be made available for the trees when they are ready to commence growth in the spring. Quantities will be governed by the condition of the trees and the soil type, but to maintain quality and average production the available supplies of phosphates, nitrates, and potash should be commensurate with the trees' requirements. Nitrate of soda as a stimulant to lagging growth should be applied as growth commences. Periodic dressings of lime are necessary to obtain full value from the manures and improve the soil-texture.

Pruning.

Pruning may be started as the growth ripens, commencing with stone-fruits and following with the pomes. In practice there are so many deviations from all well-defined systems—rendered necessary by varietal peculiarities, physical condition of the tree, age, &c.—that any definite directions are apt to be misleading; but broadly the general principles apply throughout, and by noting the fruiting habit of the tree and its response to previous prunings any modification necessary can be made on well-defined lines. Briefly the objects of pruning are: To build up and maintain a physically strong tree of a size and shape best suited for convenience and economy in management; to maintain the balance between wood and fruit production, and ensure an annual average production of fruit of even size and quality; to regulate or modify the growth, in order to obtain an even distribution of the fruiting-wood throughout the tree.

In orchard practice pruning must be accompanied by cultivation and manuring to maintain vigour, and spraying to control diseases which retard or destroy growth. Although cultivation at times can be suspended with advantage as a means towards reducing wood-production and promoting fruitfulness, neglected cultivation or manuring, especially in peaches or nectarines, may produce a condition of stagnation which renders satisfactory pruning almost impossible. Just as growth is essential to satisfactory pruning, so is pruning essential to satisfactory growth, inasmuch

as the tree's efforts are directed towards smothering any possible contender for a place in the sun, and in so doing developing its highest points to the detriment of those less favourably situated, until from an economic point of view the tree is of little value.

To counteract this tendency a limited number of well-placed limbs are selected, and by annual pruning wood-production is encouraged with a view to developing fruit under the most advantageous conditions. One of the essentials to quality fruit is the free access of ample light to all portions, and to this end the removal of any growth crowding the centre or causing dense places in the outer fringe claims first consideration. In this connection it is necessary to bear in mind that comparatively upright growths during the winter will approximate the horizontal under the weight of a crop of fruit, and allowance should be made to avoid overexposure.

Dealing in particular with peaches and nectarines, where the fruit is borne on growth produced the previous season, provision for ample renewal of wood is necessary. Left to its own devices the tree will make more wood than is desirable, and each season the fruiting-area will get farther out of reach and many of the light twiggy growths will die out. Various methods of treating the young growth are practised, but the general principle in each is to remove at their bases about half of the one-year laterals, cutting the weedy ones and leaving alternate strong ones for the next season's fruiting. From the basal buds of those which were removed, young shoots should arise during the next growing season for the following season's fruiting. By shortening the shoots which have borne fruit and thinning the young ones provision is made for a continuous supply of fruiting-wood and much of the labour of thinning the crop is avoided. Any shortening of limbs is done by cutting back to a suitable lateral with an outward tendency. Excepting varieties which habitually set the bulk of the crop towards the base of the laterals or evenly throughout their length, any shortening of laterals is not desirable, as with tip-bearers the crop may be severely reduced.

Apricots: In some districts the prevalence of silver-leaf (silver-blight) is making growers chary of pruning apricots, but unless heavy and continuous manuring is followed to maintain vigour the fruit must deteriorate in size and quality, and the probability of the disease gaining entry through accidental breaks in the unwieldy limbs discounts any possible benefit. In suitable localities apricots are vigorous growers, and liberal pruning is necessary to keep the trees within bounds. A dense head should be avoided if the fruiting-brush is to be retained on the lower portion of the tree. The fruit is produced on comparatively short-lived spurs and on the previous season's growth, necessitating a system of constant renewals. Shortening the one-year wood will promote the formation of spurs and shoots of varying strengths, some of which will be retained for fruiting and the remainder eliminated to avoid overcrowding. Frequent duplication of the leaders should be avoided, and any promising shoots on the main limbs encouraged by shortening. Some judgment is required in determining at what length the young wood should be cut, for if left too long the lower buds will not break, and if too short an excess of strong shoots detrimental to fruit-production will result.

Citrus Culture.

Conditions favouring the development of citrus brown-rot will still prevail, and the 4–4–40 bordeaux must be maintained, particular attention being given to the lower parts of the tree to prevent the upward progress of the disease. Prompt and regular harvesting should be attended to, so as to prevent ripening proceeding beyond the silver or pale-yellow colour best suited for curing. Sweet oranges should be allowed to properly mature before picking, in order to obtain full flavour; with greater discrimination

in selecting only well-ripened fruit much of the prejudice against locally grown oranges should be overcome. Poorman oranges for table use should be harvested while the flesh is tight and compact, so as to secure the maximum juice content.

Trees for new plantations should be secured as early as possible, and if conditions are not suitable for planting they should be laid-in until required. It will be found more satisfactory to obtain supplies early in the season, while stocks are large, than later when the stock is depleted. In frost-free localities planting may proceed when soil conditions permit, but where there is any danger of frost it is advisable to defer planting until the spring. Wherever possible trees with a single stem should be selected, and, although it may appear drastic, trimming to prevent branching for at least 2 ft. from the ground will be a benefit in future years. Lemons will not thrive under waterlogged conditions, but good results can be obtained in low-lying ground by throwing up a mound about 6 ft. across and planting on the top. Mulching in the summer may be necessary under these conditions, but better growth is assured. Unprofitable varieties or trees of poor type may now be headed back to stimulate the production of young growth suitable for budding next season.

—G. H. McIndoe, Orchard Instructor, Gisborne.

POULTRY-KEEPING.

Preparations for the Ensuing Breeding-season.

THE necessity for not neglecting any detail that will ensure having the breeding-stock and the hatching and rearing appliances in the best possible condition for the forthcoming breeding-season cannot be too strongly emphasized.

Where it is intended to commence hatching early in July—which is a good time for bringing out pullets for the production of eggs in autumn, when egg-prices have a rising tendency—the breeding-pens should be mated up with as little delay as possible. It is a mistake to leave the mating until just before eggs are required for hatching purposes. The birds should be given an opportunity to settle down and become accustomed to their new surroundings. Especially does this apply to birds taken from a free range and placed in confined quarters. In such cases they will usually fret, and it cannot be expected that eggs containing strong germs will be produced by birds in this condition. Another advantage in early mating is that the eggs can be tested for their fertility before being actually required for reproductive purposes. It sometimes happens that a vigorous male bird will exhaust itself at the outset and it will be some weeks before satisfactory fertility is obtained. This may cause the postponement of the hatching-period, probably through inability to secure a fresh male. It is always a wise policy to have a spare male at hand as a standby.

Poultry-keepers who have acted in accordance with the advice given previously in the *Journal* will have selected and specially marked the best breeding specimens during the late autumn, or at some time before the birds moulted. It is at that period of the year that certain signs whereby the good layer can be distinguished from the poor one manifest themselves in a striking manner. If nothing is known about the laying ancestry of a fowl she assuredly must be judged on her own performance, and there is no better rough guide to performance than the time at which she moults and the extent of that moult. The bird which holds out longest—the most persistent layer—is the bird that carries away the chief honours at the egg-laying competitions. In other words, the first

bird to moult is too often the last bird on the list when the year's yields come to be published; and the experience of the egg-laying competitions is being repeated on private plants all over the country. Obviously when the choosing of the breeding females has been left till now, when the flock has moulted and all the birds are in a similar condition so far as their plumage is concerned, it is impossible to distinguish between the early and late moulter, except of course when they have been specially marked to indicate this point. The poultry-keeper who has neglected to select his late moulters may expect a high proportion of unprofitable stock as a consequence.

Mating and Constitutional Vigour.

In recent issues of the *Journal* much advice has been published as to the points to be looked for when selecting a good breeding specimen, and these need not be repeated here, except to say that when the final selection is being made the greatest care should be exercised to ensure that no bird of either sex is placed in the breeding-pen unless it possesses the desired vigour. It should be remembered that in a natural state constitution is effectively maintained, the strongest male selecting the best breeding female by force. With the advance of civilization, and man's interference with the breeding of animals which he has domesticated, natural selection is rendered more or less impossible.

The history of the domesticated fowl is a striking instance of this. With the natural process of selection rendered impossible, we have improved the egg-yielding capacity to such an extent that exceptional stamina is demanded if the modern layer is to continue its great artificially induced production without bringing about its own deterioration. The fact cannot be too strongly emphasized that the greater demand we make on a fowl as regards egg-yield the greater the care we must exercise in seeing that her vigour is not impaired in the process; while we must take every means to ensure that she has all possible care and attention, particularly in the housing and feeding.

Disease, particularly intestinal parasitic infestation, is what the poultry-keeper has most to fear, and we know that the more we remove the animal from natural conditions of life and production the greater the tendency to troubles of this sort. The only way of fighting them is by never allowing the constitution to deteriorate, housing the birds in airy but draught-proof roomy quarters, and feeding them liberally. The more artificial the animal the greater the care demanded by the owner, and there is probably no domesticated animal of a more artificial type than the New-Zealand-bred heavy-egg-producing White Leghorn. Thus, even where the late moulters are concerned, every bird should be carefully examined in order to ensure that it is healthy and possesses constitutional vigour before being admitted to the breeding-pen. No matter what other good points are possessed, whether it be male or female, if there is the slightest constitutional taint the bird should be rejected as a breeding specimen.

Brooders and Incubators.

As already indicated, a matter that should be now attended to is overhauling the incubator and brooder appliances. Everything should be done to rectify anticipated trouble, such as providing fresh burners for lamps for those that are worn out and unreliable, replacing connecting-rods for the incubators where the old ones have become bent, or new thermometers for those which have become broken. It is also a good plan to always have a good store of lamp-wicks of the correct sizes to fit the lamp-burners. It frequently happens that duplicate parts of incubators

and brooders are difficult to secure, especially with imported appliances. Failure to attend to these little details now may cause endless worry and loss of time at a later date.

—F. C. Brown, Chief Poultry Instructor, Wellington.

THE APIARY.

Care of Hives.

At no other season is the welfare of the colonies of such importance as during the next few months. Every hive should be raised from the ground to the height of one brick, and if the situation is damp or low-lying it is a good plan to raise the hives still more. This will tend to keep them free from slaters (wood-lice) and other insects, and will afford less harbour for mice, as well as ensuring a free current of air beneath the bottom-boards, which are thus more likely to keep dry. The bottom-boards should never be rested on the ground, or they will rot in a very short time and become mouldy and evil-smelling.

Before bad weather sets in it is a good plan to give a coat of paint wherever it is needed, at the same time stopping up all cracks in the supers. Cracks afford ventilation during the summer months, but they are hardly to be advocated on that account, because the beekeeper will usually find that towards the end of the honey-flow the bees will use much valuable time in gathering propolis to paste up the cracks in view of the approach of winter. The hives should be slightly canted forward, so that any rain which falls on them will drain off the alighting-board.

Apart from disease, there is no worse feature in an apiary than the presence of leaky hive-covers. A roof which allows moisture to trickle through is a constant menace to the colony it appears to shelter. Not only will the mats immediately beneath it become sodden and mouldy, but the cluster of bees in the hive stands in danger of extermination when frost sets in. There will then be pollution unspeakable on the bottom-board, where the intruding moisture mixing with dead bees and waste pollen forms a rotten fermenting mass, with a stench which the order-loving bees must find more obnoxious than does their owner. There is no excuse for leaky covers. In the autumn the apiarist should examine them for any doubtful spots, and should cover them with either zinc, ruberoid, or some other waterproof material. If economy must be practised he may cover with cheesecloth, applying to the roof first a coat of paint, then the cheesecloth, and then another coat of paint. This makes an effective waterproofing, and one which anybody can apply.

Removing Spare Supers.

As advised last month, all top boxes not actually occupied should be removed and the bees made as snug as possible. If the colonies have been well cared for, and are headed by good queens, they will need at least one top box in addition to the brood-chamber, which will be fairly crowded with young bees bred since the close of the main honey-flow. These are colonies that the beekeeper should strive to have, as they will come out strong in the spring and give the best returns when the next season's honey-flow arrives. In removing supers at this time every care must be exercised to avoid robbing. There will be bees in the supers to be removed, and these can be got rid of by using bee-escapes. By putting these on in the evening the supers will be clear of bees in the morning, providing there is no brood in the combs. All operations at this period should be carried out as expeditiously as possible so as not to attract robber bees, which are much in evidence during the warm hours of the autumn days.

The Annual Conference.

The 1930 conference of the National Beekeepers' Association is to be held at Auckland on 15th, 16th, and 17th July. The conference has been arranged to coincide with the winter show in Auckland. Delegates from all parts of the Dominion will be present, and lectures and demonstrations by leading commercial beekeepers will be given.

E. A. Earp, Senior Apiary Instructor, Wellington.

HORTICULTURE.

Pruning and Manuring of Bush Fruits.

THE crop produced from areas planted in bush fruits is very commonly low in quality and quantity, owing to the neglect of suitable pruning and manuring. The bushes then become crowded with stunted growth, and the fruit is small and tiresome to gather. Most plantations of this class may be brought back into good bearing condition by careful attention now to pruning and manuring.

The black-currant bushes especially should have a number of the older growths cut low to encourage the production of strong fresh wood, as it is on growth of that kind the best fruit is borne during the following season. By means of this simple treatment now, and generous manuring, most plantations would produce larger crops and a better sample of these popular berries.

Gooseberry-bushes are usually far too crowded with growth for maximum cropping, which can only be obtained by opening up the plant to admit light and air. In such cases the crowded framework should first be thinned out well, and all suckers and strong water-shoots about the centre of the bushes removed entirely. When this is done weak young laterals and those that cropped last season should be cut back to the buds at the base. This leaves the strong young wood well spaced for cropping during the coming season. From these young growths the unripened tips should be removed. This may be rather a heavy task, but if it is followed up annually the bushes soon assume a thrifty habit that makes the work much lighter.

Red and white currants are now in better demand. The former especially is in great request for jellies and mixing with other fruits to give preserves colour. Instead of producing the fruit on young wood, as in the case with the black currant, they bear the crop on spurs on the older wood. For this reason suckers should be entirely suppressed, and the leading growth should be only lightly shortened, if at all, in established bushes. Contrary to the black variety, again, the centres must be kept open to admit light and air, the stronger superfluous laterals being removed completely. The lighter laterals may be shortened with a view to the formation of fruit spurs, although this is often best done in summer as a check to the overvigorous growth to which these plants are liable. It is unusual to see these bushes correctly treated, but where it is done the results form a striking contrast.

When the pruning is completed, and the trimmings removed and burnt, these and similar plantations of small-fruits should be given a good dressing of fowl or other manure. This should be in a friable, fermented state and well harrowed in. If the land is deep and rich and ploughing has been usually done it may be turned under in that way, but the fibrous roots of such plants are usually very near the surface, and often it will be advisable to work the manure in with a cultivator.

For the first two or three years after laying down new plantations of bush fruits one is chiefly concerned in pruning the plants to induce plenty of vigorous growth that is well spaced out, and which may be suitable for the formation of a permanent frame. For such reasons as this new plantations of raspberry-canes should be cut down to a height of 6 in. from the surface of the ground, and young gooseberry-bushes should have two or three of the strongest shoots selected and shortened to side buds to form the base of the main framework of the plant. In doing this it is convenient to have plenty of shoots from which to make a selection, but one must avoid the temptation to leave in too many, as such action will lead to the bush becoming crowded with growth, and thinning is then a big undertaking and delays the development of the plants.

There is room in the alleys of such young plantations to grow a vegetable crop of a shallow-rooting character for the first season. If the land is properly prepared—that is, clean and richly manured—there is no need to miss a crop, so long as the bushes are protected from encroachment.

Preparing for Tomatoes and Cucumbers under Glass.

Those who are growing tomatoes and cucumbers under glass will now be busy preparing to commence a new season. Sterilizing soil for seed-boxes, making up hot-beds, cleaning down or fumigating the interior of glasshouses (where this has not yet been done satisfactorily), and trenching or digging the land under glass, and generally preparing it for planting at the end of the month of July or August, are the opening items of a busy programme of production.

Sufficient fresh stable manure for making hot-beds is often unobtainable, and it is then advisable to carefully conserve any supplies of fallen leaves from deciduous trees that may be available in the vicinity. Mixed with the stable manure they serve the purpose admirably; in fact, satisfactory hot-beds may be made with leaves alone when they are properly fermenting.

In a new glasshouse the first crop or two is phenomenally successful in most cases, and a pleasing confidence is established, which, however, is often rudely upset in the course of time by the attack of diseases and pests. The manager of glasshouses has to be continually on his guard, and the best opportunity which offers for defeating these attacks is when the house is empty. The inside may then be well sprayed down with 1 per cent. or 2 per cent. of a formalin solution if mildew, moulds, or other fungous diseases have been prevalent during the past season, and even the soil saturated and covered with sacks for two or three days to retain the effective gases which are liberated. If insect pests have been troublesome a good contact insecticide or fumigant will best meet the case.

The brickwork in cucumber-houses should be swept down with a hard brush and given a coat of hot limewash. A little cement added will make it stick better, and a handful or two of flowers of sulphur or a small quantity of kerosene stirred in a pail of wash will increase its cleansing properties.

The Market-garden.

The very common practice of allowing land to remain undisturbed after a crop is removed, and deferring its preparation until shortly before it is to be planted again, is very unsatisfactory management. Under such circumstances pests in the ground thrive, and the opportunity for slow-acting manures to become effective before planting is lost, as also is the opportunity of growing a hardy green crop for turning in. By ploughing the ground as soon as the crop is removed, and leaving it rough, many pests are destroyed by the disturbance, and birds have an opportunity of feeding on the noxious larvæ. Lime, basic slag, bonedust, or kainit

are useful alternative dressings that can often be used with great advantage, and these with organic manures turned in now have time to become assimilated, so that the ground is in good heart when it is further broken down and cultivated just before the spring planting. Under such treatment slugs, snails, wireworms, and cutworms are destroyed easily, and the loss of young plants in the springtime is most readily avoided. Those who have light land by the seashore cannot do better than use what supplies of seaweed are available. Such manures are equal in cultural value to that from the farmyard, and are specially suitable for sandy ground if ploughed under now.

Seed potatoes should be given light and air to prevent them sprouting. Where the quantities are large and in sacks, they may be turned occasionally, but stacking should be avoided; as an alternative the stocks may be stored in slatted cases in an airy place. Where seed has to be bought it should be obtained without delay, as there is considerable competition for good seed, and the important matter of careful storage can be ensured. At one time it was most difficult to obtain pure lines of sound seed, but the Government system of potato-seed certification is gradually improving the supply, and seed true to name and free from the mysterious virus diseases that have caused such serious loss in the past may now be obtained.

Lettuce and other plants growing in frames in preparation for planting out next month should receive careful attention. Leaking sashlights and a close atmosphere create conditions that quickly infect the plants with fungous disease, which develops often only after the plants are set out. By keeping the plants on the dry side and giving plenty of air on every suitable opportunity they may be kept strong and hardy, and most of the losses from rust and sclerotinia will be avoided.

The Home Garden.

Bare patches on lawns may now be repaired by neatly inlaying suitable fresh turf. Depressions can be levelled up by peeling back the turf and filling up with good soil made firm and the turf replaced. Similarly, sections that are too high may be lowered by removing the soil. The improvement of lawns and grass verges is very great where such attention is given now.

Most shrubberies and plantations would also be improved by suitable thinning and pruning. Fine specimens are often injured by the crowding of less valuable plants; the latter should be removed, or at any rate pruned well back. Conifers with double leaders, and trees and shrubs with crowded and crossing limbs, should have such superfluous growth entirely removed as well as all dead wood. Besides the greatly improved appearance, they are less likely to be damaged by winds, and the plants are greatly invigorated. Laurel, taupata, and similar hedges are frequently found with crowded overhanging tops and a weak open base. To make such hedges presentable the face should be cut vertically—in fact, the top should be rather narrower than the base. The lower portions of the hedge will then improve greatly from the increased light and nourishment received.

On the other hand, while a good thick hedge is always admired, the growth sometimes becomes too tightly interlaced. In such instances some thinning with the secateurs will often strengthen and deepen the foliage on the face and much improve its appearance. As such hedge-pruning causes some disfigurements until new growth takes place it is usually deferred until the end of August or beginning of September, when new growth takes place almost immediately. Carefully considered treatment along these lines produces a handsome hedge that is very ornamental, and produces that well-kept appearance which is creditable to garden management.

—W. C. Hyde, Horticulturist, Wellington.

CERTIFICATION OF SEED POTATOES.

PROVISIONAL CERTIFICATES ISSUED FOR SEASON 1929–30.

A LIST of growers who have received provisional certificates in connection with the official certification of seed potatoes in the past season is printed below.

Provisional certificates are issued with the object of affording growers some indication of the general standard of their crops and assisting them in the disposal of their seed. Certificates and certification tags are issued later, provided that an officer of the Department of Agriculture inspects the graded seed potatoes, and is satisfied that they are still of the same standard in regard to purity and freedom from disease as was indicated by the field inspections.

It will be noted that this year the cropping-power of each line is also published. The cropping-power has been determined by means of trial plots undertaken by the Department, and is calculated by adding together the yield of table tubers and half the yield of seed-size tubers. Differences of 1½ tons per acre or more may be regarded as definite differences in cropping-power. Differences of 1 ton per acre, while not significant, may be taken as an indication that there is some slight difference. Differences of ½ ton per acre cannot be regarded as reliable differences.

LIST OF GROWERS.

Growers and Varieties.	Cropping-power in Tons per Acre.	Acreage.
Aucklander Short-top (N.Z. Sutton's Supreme) :—		
Canterbury Seed Co., Leeston (line B)	14·0	2
D. Marshall, R.M.D., Killinchy	10·0	5
J. Jellie, Russley Road, Fendalton (line A)	10·0	3½
W. E. Martin, R.M.D., Kaiapoi	10·0	6
R. Barnett, Dunsandel	9·5	5
Canterbury Seed Co., Leeston (line A)	9·5	2
Muff Bros., Orari	9·5	4
T. O'Brien, St. Andrews	9·5	1
A. D. Carroll, R.M.D., Southbridge	9·0	4
Weeber Bros., Englefield Road, Belfast (line A)	8·5	2½
A. J. Rich, R.M.D., Kaiapoi (line B)	8·5	5½
C. Redmond, Kimberley	8·5	6
J. Jellie, Russley Road, Fendalton (line B)	8·0	6
M. Breen, Levels	8·0	4
F. Brundell, Camside, Kaiapoi	8·0	5
A. J. Rich, R.M.D., Kaiapoi (line A)	7·5	5½
W. Oakley, Halkett	7·5	1
E. A. Smith, Lincoln	7·5	5
Weeber Bros., Englefield Road, Belfast (line B)	7·5	4
L. Seyb, Washdyke, Timaru	7·5	1
G. Gudex, Washdyke, Timaru	7·5	1
J. Rouse, Pareora, Timaru	7·5	2
F. C. Herridge, Woodend	7·5	1
C. H. Jordan, R.M.D., Kaiapoi	7·5	5½
G. Harris, Orakipaoa, Temuka	7·5	3
E. H. Daniel, Kingsdown, Timaru (line B)	7·5	6
Aucklander Tall-top (N.Z. Sutton's Supreme) :—		
H. S. Moore, Box 4, Kaiapoi	14·0	15
M. S. Kelly, 502 Lincoln Road, Halswell	11·5	1
J. Warren, Russley Road, Fendalton	10·5	12
G. Jones, "Vale Royal," Halswell	10·5	1

LIST OF GROWERS—*continued.*

Growers and Varieties.	Cropping-power in Tons per Acre.	Acreage.
Aucklander Tall-top (N.Z. Sutton's Supreme)—contd.		
J. Bailey, R.M.D., Kaiapoi	10·0	8
Weeber Bros., Englefield Road, Belfast	9·0	6
J. D. McMullan, Elmwood, Kaiapoi	8·0	10
L. Seyb, Washdyke, Timaru	8·0	3
Dakota :—		
C. E. Walker, R.M.D., West Melton	11·5	5
W. J. Crozier, Mitcham, Rakaia (line A)	10·5	2
M. S. Kelly, 502 Lincoln Road, Halswell	10·5	2
Munro & Scarth, Rokeby, Rakaia	10·0	2
F. McNae, R.M.D., Courtenay	9·5	1
W. Gee, Springlands, Blenheim	9·5	1½
T. Small, Mitcham, Rakaia	9·5	3
S. Cross, R.M.D., Rolleston (line B)	9·5	9
W. J. Crozier, Mitcham, Rakaia (line C)	9·0	2
W. A. McPhail, Mitcham, Rakaia	9·0	20
S. Cross, R.M.D., Rolleston (line A)	9·0	16
A. J. Breakwell, Tinwald, Ashburton (line C)	9·0	7
E. Hinton, Templeton	8·5	4½
L. Seyb, Washdyke, Timaru (line A)	8·5	2
G. Gudex, Washdyke, Timaru	8·5	1
P. J. Thornton, Harewood Road, Papanui	8·5	4
J. Curragh, Templeton	8·5	1
P. J. Gill, Box 11, Kirwee (line A)	8·5	2½
W. J. Crozier, Mitcham, Rakaia (line B)	8·0	2
S. Tweedy, Dunsandel	8·0	5
R. Hewson, Seadown, Timaru	8·0	4½
S. Palmer, Burnside Road, Fendalton	8·0	2
J. Argyle, Allenton, Ashburton	7·5	2
J. H. Doak, Barr Hill, Rakaia	7·5	13
R. McDonald, Waikuku	7·0	8
Jas. Carr, Highbank, Methven	7·0	8
H. M. Marshall, R.M.D., Weedons	7·0	2
Arran Chief :—		
C. E. Knowler, Tuatapere	10·5	2
A. C. Townshend, Woodstock, Darfield	7·0	2
G. Jones, "Vale Royal," Halswell	6·5	1½
Bresee's Prolific :—		
F. W. Carpenter, Prebbleton	6·5	17
Jas. Carr, Highbank, Methven	6·5	8
D. Marshall, R.M.D., Killinchy	5·5	27
W. Chappell, R.M.D., Killinchy	5·5	2
L. Seyb, Washdyke, Timaru	5·0	2
G. Pierce, R.M.D., Killinchy	5·0	8
A. Allen, R.M.D., Killinchy	5·0	14
King Edward :—		
A. Anderson, Stirling (line B)	8·5	1½
A. H. Rose, Glencoe, R.M.D., Invercargill	8·0	1½
L. King, Glencoe, R.M.D., Invercargill	8·0	2
W. E. Brown, Orepuki	8·0	1½
C. E. Knowler, Tuatapere	7·5	2½
J. McLeary, Mataura Island	7·5	2½
A. A. Jensen, Stirling	7·0	3
O. S. Mosley, Stirling	7·0	7
R. M. King, Tuatapere	7·0	3½
Up-to-date :—		
C. E. Walker, R.M.D., West Melton	11·5	2
H. D. Norman, Tuatapere	8·0	1

LIST OF GROWERS—*continued.*

Growers and Varieties.	Cropping-power in Tons per Acre.	Acreage.
Northern Star :—		
J. T. Brown, Pahia	9·0	.1
Epicure :—		
G. McLachlan, R.M.D., Southbridge	9·5	11
W. Shellock, R.M.D., Mead, Rakaia	7·5	4
D. Marshall, R.M.D., Killinchy	7·0	10
L. T. Wright, Annat	4·5	3
E. W. Mote, 98 Grant's Road, Papanui ..	4·0	1
Majestic :—		
C. H. Wilson, Lorne, Invercargill	6·5	1
A. J. Clark, Box 34, Rangiora	6·5	10
Early Regent :—		
M. S. Kelly, 502 Lincoln Road, Halswell ..	3·5	2
J. Curragh, Templeton	3·0	1½
Endurance :—		
H. Weaver, Bankside	12·0	3
Iron Duke (Aberbrothok) :—		
H. Hancock, Awahuri, Palmerston North ..	10·5	12
Field Marshal :—		
L. T. Wright, Annat	9·0	5
Great Scot :—		
A. Spillane, John Street, Temuka	5·5	3½
Golden Wonder :—		
J. Warren, Russley Road, Fendalton	6·0	1
Maori Chief :—		
E. R. Wilson, St. Andrews	9·0	2
Robin Adair :—		
D. Marshall, R.M.D., Killinchy	6·5	3
North Downs :—		
L. Galletly, Maronan, via Ashburton	4·0	2
Brownell's Beauty :—		
F. McNae, R.M.D., Courtenay	10·0	3
Northern Star :—		
W. Buttery, Pukekohe	*	½
L. J. Bayley, Pukekohe	*	½
E. J. Campbell, Pukekohe	*	2
G. Gathercole, Pukekohe	*	1½
R. E. Morland, Pukekohe	*	½
J. W. McMiken, Pukekohe	*	7
H. Wilcox, Buckland	*	4

*No cropping-power figures available.

—*Fields Division.*

Sheep-shearing.—In his interim report on wool-production in New Zealand Dr. J. E. Nicholl refers to this subject as follows: "There is much controversy respecting the merits of blade as opposed to machine shearing, and in many flocks a return has been made to the former, it being claimed that when blades are used the short fleece left on the animal is a better protection against untoward weather conditions, and that it is possible with the British breeds to take better advantage of the 'rise' in the wool. In this connection it may be mentioned that the time of shearing and the nutriment available to the sheep after shearing may possess a definite bearing upon the presence of 'thickened tip' in the next fleece."

DOWN-CROSS EXPORT LAMBS FROM RUAKURA.

TOGETHER with the breeding of pedigree dairy cattle, sheep, and pigs, and the production of butterfat, the raising and fattening of lambs for export is an important activity at the Ruakura Farm of Instruction, Hamilton. Southdown rams are used on Romney crossbred ewes of the farm flock, with excellent results.

During the past season 1,672 fat lambs were shipped to London through the Auckland Farmers' Freezing Co. From the first consignment of 510 carcasses a special display was made at Smithfield by the Overseas Farmers'

DISPLAY AT SMITHFIELD MARKET OF SOUTHDOWN CROSS LAMBS BRED AND FATTENED AT RUAKURA FARM OF INSTRUCTION.

Co-operative Federation, who marketed the lambs, as shown in the accompanying photograph. The following extract from a letter received from the Federation is interesting and speaks for itself :—

"These lambs shown on Smithfield Market to-day were an excellent representation of the quality one is learning to expect and respect from the Auckland Farmers' work. They were shapely and well covered, giving a depth of meat which one always finds in the Down-cross ; as a parcel representative of the quality now slaughtered regularly in the Auckland district one cannot praise it too highly. As has been the opinion of a few here for some years past, the Auckland brand is now coming into its own, due in great measure to the predominance of the Down. It is not so many years ago that these lambs were at a discount, due mainly to indifferent breeding and slackness in grading. Now this has all been changed, and the Auckland lamb is fast coming to the fore, with a round shapely carcass, thick and chubby, full of meat, and of good colour."

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

BLINDNESS IN SHEEP.

J. F. ROLLEY, Marohemo :—

Can you tell me what causes blindness among sheep at this time of the year (April) ? I have several cases where the sheep are totally blind—running into fences, &c., as proof. Is there a cure for this ?

The Live-stock Division :—

The origin of this blindness in sheep is accepted as being due to some dietetic cause, and therefore the feed is the primary cause, although it may only temporarily be the cause. It is advisable at all times to change the flock on to different pastures at intervals, as found convenient. Animals affected should be kept in a shady paddock by themselves, so that they may be better looked after and given treatment. The remainder of the flock should be shifted about, thus giving them more exercise and a better chance of not contracting the disease. The affected animals should be given a dose of Epsom salts—say, 4 ozs. dissolved in a pint bottle of warm water and a little treacle. The eyes may with advantage to the comfort and recovery of the animal be treated by washing with a little boracic acid dissolved in hot water (a tablespoonful to the quart bottle) and afterwards putting into the eye a few drops of hydrogen peroxide solution (one part of the hydrogen peroxide to four or six of water). So far as this disease is concerned there is no specific cure. One has to use ordinary common-sense as regards removing affected animals and applying treatment in the early stages.

CONTROL OF BURDOCK ON HILL COUNTRY.

M. G. WILLIAMS, Wairoa :—

Please advise me as to the best method of getting rid of burdock from hill country—how to kill the roots, and the best time of year for doing it. The burdock is at present confined to small patches, but is showing signs of rapid spread.

The Fields Division :—

The occurrence of burdock on your property should occasion no alarm, provided you allow stock access to it. No doubt it is growing in isolated inaccessible spots not traversed by stock. If stock have access, it will readily be grazed and probably eaten right out. If this procedure is not possible, the only other method of control would be to grub it out. The Fields Division has had distinct success in spraying certain soft weeds, such as ragwort, &c., with sodium chlorate as a means of eradication, but so far has not tried this remedy on burdock. Should you possess a knapsack spray-pump and be desirous of making a test with this spray on burdock a small quantity of sodium chlorate could be supplied for trial.

FARM PRACTICE FOR PHOSPHATE DEFICIENCY.

"DAIRY-FARMER," Kaihiku :—

As my cows are inclined to chew bones and sticks I propose adding some salt to their pasture when I top-dress the field. Can you please advise me how much per acre of salt would be a reasonable quantity. (I have in hand some waste salt from the hide-stores.)

The Live-stock Division :—

The inclination to chew bones and sticks is usually indicative of a phosphate-deficiency. In many districts where this habit was once quite common it has

been completely overcome by cultivation and the extensive use of phosphatic manures, principally superphosphate. Your top-dressing should therefore consist largely of phosphatic manures, 3 cwt. to 4 cwt. per acre in the spring, and lime in the autumn. There is no reason why you should not use the salt you have available, applying anything from 1 cwt. to 3 cwt. per acre. The provision of salt in the form of rock salt for the cattle to lick would be an advantage. In order to increase the amount of phosphate available, you might use the following lick, which could be put out in boxes in the paddocks: Steamed bonemeal, 100 lb.; coarse agricultural salt, 50 lb.; sulphate of iron, 2 lb.

TREATMENT OF WARTS ON COWS' TEATS.

"DAIRYMAN," Hastings:—

Could you give me a prescription for curing warts on cows' teats. I have several cows affected, and always wash the teats before milking and put crude castor-oil on them. This certainly keeps the warts from becoming dry and hard but does not cure them.

The Live-stock Division:—

As castor-oil does not appear to give you satisfactory results for the elimination of warts on the teats more effective measures should be tried. During the non-lactation period it will be advisable to snip off the warts at their base with a pair of sharp scissors. Afterwards lightly dress the resulting cut surface with a stick of caustic silver nitrate. This procedure has been found quite effective.

OATS AND VETCHES FOR ENSILAGE.

"SUBSCRIBER," Kohuratahi:—

Please advise me whether it would be good practice to sow oats and peas (or vetches) in September, following a swede crop. I would want the crop for ensilage to be harvested early in January. If this procedure is advisable, what kind of oat would be best?

The Fields Division:—

It would be quite good practice to follow the swede crop with a mixture of oats and peas (or vetches) sown in September, and this should give you a good bulk of well-balanced material in December or January for ensilage. Sow Algerian oats, 2 bushels, with 1 bushel of vetches, per acre. Vetches are preferable to oats, as peas usually come to maturity ahead of the oats, while for your purpose vetches would provide their greatest bulk and be about the same stage of growth as the oats when cut.

RIDDING LAWN OF YARROW.

W. T. GARTHWAITE, Dunedin:—

Will you kindly advise me the best method to adopt to rid my lawn of yarrow.

The Horticulture Division:—

The best method to adopt depends on the circumstances. If the yarrow is distributed generally over the surface it will be necessary to dig the lawn up and clean the land before resowing with grass-seeds that are free from serious weeds. Or by hard raking and close cutting at this season it can be checked to permit the grasses to become better established. If the yarrow occurs only in isolated patches it may be carefully removed now and replaced with suitable turf.

Introduction of Ship's Garbage prohibited.—An amending regulation under the Stock Act for prevention of the introduction into New Zealand of stock-diseases, gazetted on 17th April, prohibits the introduction into the Dominion from vessels arriving from other countries of any organic refuse, garbage, galley-scraps, or other waste.

WEATHER RECORDS: APRIL, 1930.

Dominion Meteorological Office.

General Notes.

April was remarkable for the high proportion of dry and sunny weather and the relative absence of storms. There was a prevalence of anticyclonic conditions with southerly winds. Consequently, although the amount of sunshine was above normal, temperature was slightly below and frosts were rather numerous, especially in the South Island.

The rain which fell did not occur in general heavy falls, but was rather erractically distributed; much of it came in the last three days of the month. Taranaki and the Manawatu districts fared well, but in parts of the remainder of the country, and especially Canterbury and Otago, March and April both having been on the whole cool and dry, there is likely to be some shortage of pasture feed during the winter. The total rainfall was above normal in North Auckland, about East Cape, over the lower-lying parts of Taranaki and Wellington, most of Marlborough, and about Nelson. In other parts it was almost everywhere below average, and in the South Island especially the deficits were large.

Throughout the month storms were almost continually developing in subtropical waters to the north of the Tasman Sea and thence eastward to beyond New Zealand. The majority of these failed to affect the Dominion directly to any great extent, though they assisted in the production of the prevailing high pressure and southerly and south-easterly winds. Though causing fine weather over most of the Dominion, the latter were responsible for unpleasant and showery weather in North Auckland and north of Napier.

There was remarkably little wind in most places during the month, and such gales as occurred were short-lived.

Snow fell on the highlands of the South Island on the 9th and 10th and the 29th and 30th, but the amounts were not large, and the mountains are unusually free from snow.

There were only three periods when rain was at all widespread. The first was from the 8th to the 11th. Between these dates all parts of the country received rain, and the total registrations were heavy at many places. The rain was due to a cyclone which appeared near Tasmania on the 5th. Pressure was high to the east of New Zealand, and the storm centre, moving slowly eastward, gradually lost intensity. It crossed the Dominion on the 8th, producing only light to moderate rains. On the 9th, however, a secondary developed west of the South Island and moved across northern Otago. The rain became more general and there were many heavy falls, especially in the South Island. Some violent thunderstorms were reported. Exceptionally heavy rain fell on the 9th in the Motueka and Moutere districts and as far inland as Tapawera. At Upper Moutere 8·19 in. were recorded, and the resulting floods were the heaviest ever experienced locally. In the district about Woodville, Pahiatua, and Waipukurau, also, there were severe thunderstorms and heavy downpours. Conditions remained rather disturbed until the 12th. On that day a cyclone centre passing north of New Zealand caused southerly gales in North Auckland.

On the 19th a cyclone which seemed likely to bring good rains to the Dominion appeared in the North Tasman Sea. Unfortunately, it took a northward course and passed between New Zealand and Norfolk Island on the 20th. Some rain fell in the northern and western parts of the North Island, Taranaki and the Wanganui and Manawatu districts experiencing some heavy falls.

On the 24th another cyclone of considerable intensity developed near Tasmania. Pressure was again high to the east of New Zealand, and, as in the begininning of the month, the storm made slow progress towards New Zealand and lost intensity. However, while it was crossing the

RAINFALL FOR APRIL, 1930, AT REPRESENTATIVE STATIONS.

No.	Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average April Rainfall.
	North Island.				
		Inches.		Inches.	Inches.
1	Kaitaia	4·02	11	0·93	3·55
2	Russell	5·38	18	1·36	3·59
3	Whangarei	7·45	21	2·11	4·45
4	Auckland	2·85	15	0·88	3·46
5	Hamilton	1·90	8	0·52	3·86
5A	Rotorua	5·91	8	2·37	4·35
6	Kawhia	2·91	10	1·10	4·64
7	New Plymouth	5·11	13	2·39	4·51
8	Riversdale, Inglewood ..	7·58	10	3·13	8·39
9	Whangamomona	5·57	9	1·42	6·62
10	Eltham	5·29	10	2·70	5·16
11	Tairua	3·76	16	1·54	6·33
12	Tauranga	3·32	9	1·60	5·08
13	Maraehako Station, Opotiki	5·38	11	2·38	4·57
14	Gisborne	1·32	12	0·37	4·20
15	Taupo	1·98	8	0·58	3·77
16	Napier	1·60	12	0·40	2·92
17	Maraekakaho Stn., Hastings	..	..	..	3·14
18	Taihape	1·55	9	0·62	3·15
19	Masterton	2·62	7	0·82	3·05
20	Patea	4·50	9	2·40	3·59
21	Wanganui	3·33	7	1·47	3·37
22	Foxton	2·93	8	0·92	2·47
23	Wellington (Karori) ..	4·27	6	1·50	3·80
	South Island.				
24	Westport	5·32	10	1·18	8·25
25	Greymouth	4·49	9	1·25	8·37
26	Hokitika	4·51	11	1·00	9·38
27	Ross	5·08	8	1·05	12·55
28	Arthur's Pass	3·35	5	1·39	16·16
29	Okuru	4·94	11	1·12	13·67
30	Collingwood	5·79	7	2·45	8·07
31	Nelson	4·72	8	1·50	2·93
32	Spring Creek	2·49	8	0·95	1·72
33	Tophouse	7·76	9	2·02	4·22
34	Hanmer Springs	1·69	6	0·93	2·99
35	Highfield, Waiau	2·96	7	1·10	2·66
36	Gore Bay	2·64	7	1·11	1·77
37	Christchurch	0·53	7	0·22	1·97
38	Timaru	1·50	8	0·74	1·51
39	Lambrook Station, Fairlie ..	1·40	9	0·68	1·95
40	Benmore Station, Clearburn	0·87	5	0·36	2·55
41	Oamaru	0·94	8	0·40	1·78
42	Queenstown	0·60	10	0·31	3·00
43	Clyde	0·36	5	0·10	1·34
44	Dunedin	1·43	11	0·54	2·82
45	Wendon	0·94	8	0·35	3·16
46	Gore	0·87	11	0·19	3·15
47	Invercargill	1·23	14	0·35	4·36
48	Puysegur Point	4·88	19	1·13	7·98
49	Half-moon Bay	2·17	13	0·57	5·29

Dominion on the 28th northerly winds brought very warm and sultry weather, and conditions became favourable for rain when the southerly set in. On the 29th the depression developed a secondary centre west of the North Island. This crossed the Dominion and finally died out on the 30th. By that time general rains had fallen, with many heavy falls from Nelson and Marlborough northwards. These came for the most part on the night of the 28th and on the 29th, and were accompanied in places by thunderstorms, the lightning being particularly severe at Auckland.

—Edward Kidson, Director of Meteorological Services, Wellington, 6/5/30.

INVENTIONS OF AGRICULTURAL INTEREST.

APPLICATIONS for patents, published with abridged specifications in the *New Zealand Patent Office Journal* from 13th March to 8th May, 1930, include the following of agricultural interest:—

No. 61631: Kapok substitute from flax; H. S. F. Wright, Wellington. No. 61632: Cotton-waste from flax; H. S. F. Wright, Wellington. No. 61831: Bleaching of fibre; A. Steven, Shannon. No. 62591: Manure-distributor; K. Butler, Inglewood. No. 62681: Milking-machine claw; J. M. Judd, Wellington. No. 62688: Harrow and scarifier; R. A. White, Hunua. No. 63619: Shearing-machine hand-piece tensioning; J. Davidson, Sydney, N.S.W. No. 63709: Manure-distributor; J. Taylor and Co., Ltd., Eltham. No. 64086: Stump-grubbing hook; C. Anderson, Shannon. No. 62296: Incubator; J. W. and B. Roundhill, Fairlie. No. 62612: Cultivator; J. E. Holland, Hillsborough, Christchurch. No. 62459: Manure-distributor; H. W. Gower, Ohakune. No. 63245: Cream-separator; A. E. Denham, Wellington. No. 63539: Butter-box; M. A. Scott, Frankton Junction. No. 62216: Apple-grading; J. Oxley, Loburn. No. 63079: Turnip and manure ridger; J. E. Mitchell, Wyndham. No. 64228: Egg-holder; J. Zimmer, Auckland. No. 64406: Hay-rake; The Farmers' Trading Co., Ltd., Auckland. No. 64461: Cheese-crate; M. A. Scott, Frankton Junction. No. 64558: Cultivator; H. Mote, London, England. No. 64605: Harvesting-machine; L. F. Moroney, Lara, Victoria. No. 62793: Harrow; C. A. Barrell and J. D. Cann, Hamilton. No. 63053: Plant-support; E. G. Hollebone, London, England. No. 63224: Chain harrow; C. A. Barrell and J. D. Cann, Hamilton. No. 64589: Mixture for eradication of blackberry; R. J. Taylor, Motueka. No. 64637: Agricultural implement; C. C. Clark, Horsham, England.

Copies of full specifications and drawings in respect of any of the above may be obtained from the Commissioner of Patents, Wellington, price 1s. prepaid.

FORTHCOMING WINTER SHOWS.

THE following dates have been notified by show secretaries:—

Waikato Winter Show Association: Hamilton, 27th May to 3rd June.
Otago A. and P. Society: Dunedin, 31st May to 5th June.
Wairarapa Winter Show Association: Masterton, 2nd to 7th June.
Taumarunui Winter Show Association: Taumarunui, 4th to 7th June.
Taranaki Metropolitan Agricultural Society: New Plymouth, 10th to 13th June.
Poverty Bay Winter Show Association: Gisborne, 11th to 14th June.
Manawatu A. and P. Association: Palmerston North, 17th to 21st June.
South Taranaki Winter Show Company: Hawera, 25th June to 2nd July.
Te Kuiti and District Winter Show Association: Te Kuiti, 2nd to 5th July.
Wellington Winter Show Association: Wellington, 8th to 26th July.
Auckland Winter Exhibition: Auckland, 9th to 19th July.
Canterbury A. and P. Association: Christchurch, 9th to 23rd August.

Correction.—Control of Ragwort: In the title of the illustration on page 293 of this issue the name "Hooper" should be "Hooker."